PLATIT®

COMPENDIUM

64

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AR You can view our units in 3D by scanning the pages marked with this symbol with our AR app.

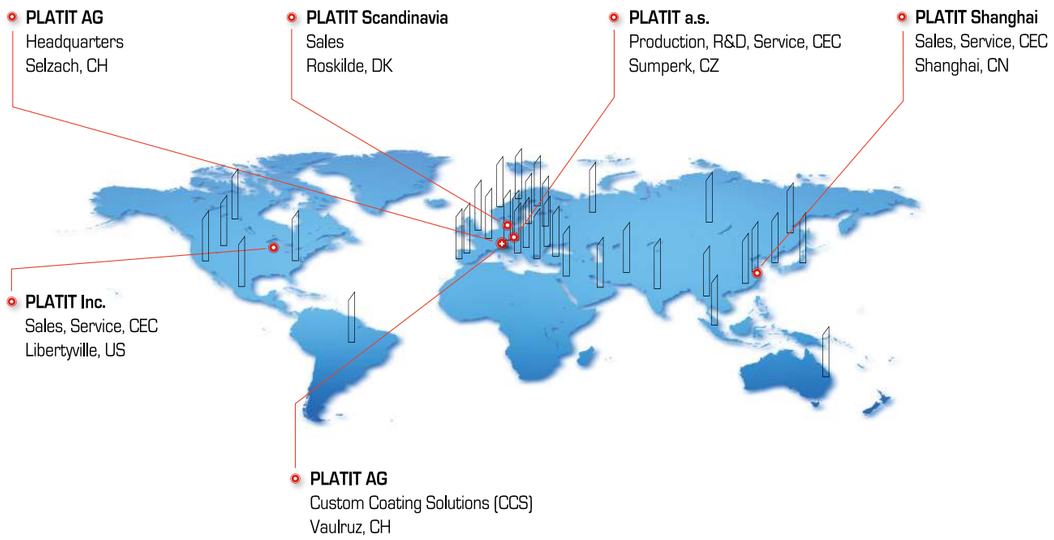
Global presence

PLATIT is a leading manufacturer of high-tech PVD and PECVD coating units for tools and components. The company is part of the family-owned BCI Blösch Group, an independent Swiss technology group. PLATIT is headquartered in Selzach (Switzerland) and has its own service, support and sales offices in Europe, North America and Asia. These are complemented by a broad network of distributors and partners worldwide. PLATIT has installed coating systems worldwide and maintains close partnerships with its customers.

The variety of tool geometries and applications requires manufacturers of coating equipment to offer a wide range of technical solutions to best fulfill customers' needs. PLATIT offers numerous high-tech standard and custom coating solutions with modular machine designs, high flexibility and proven userfriendliness. Profound competencies in cathodic ARC, SPUTTER and HiPIMS technology allow PLATIT to integrate these technologies into hybrid processes, creating solutions for different applications. PLATIT's open-source philosophy helps customers to adapt coatings to their specific requirements and individual needs. With the highest coating performance in dedicated application fields, PLATIT customers can differentiate themselves from the market standard.

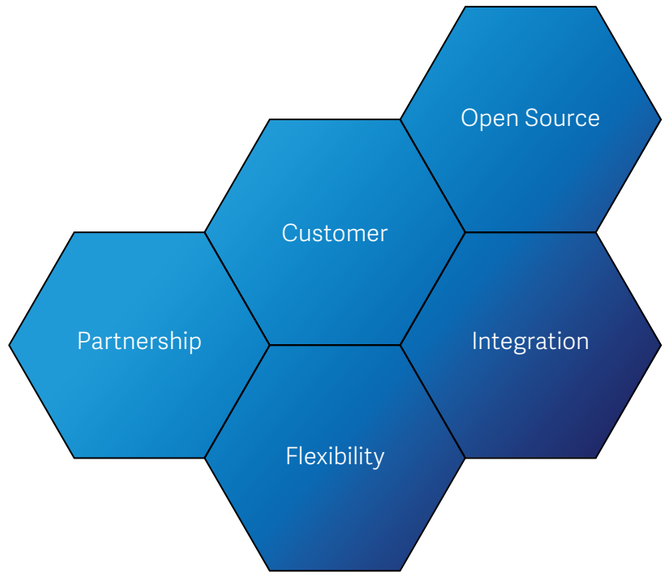
In addition to coating units, PLATIT offers turnkey systems as part of its product portfolio. These include complete solutions for upstream and downstream steps such as decoating, edge pre-treatment, cleaning, post-treatment and quality control, making PLATIT systems ideally suited for seamless integration into the tool manufacturing and regrinding process.

PLATIT has installed coating systems for customers in 41 countries around the world:



WWS PLATIT
World Wide Service

What we stand for



Core competencies of PLATIT include integrated turnkey solutions, flexible machine concepts, open-source technology and strong customer relationships.

Integration enables in-house coating. Based on our comprehensive understanding of the manufacturing and regrinding of tools, we develop optimized solutions for our customers, which we seamlessly integrate into their existing production process.

Flexibility refers to our business model and our products. Our PVD standard coating units are based on a modular design. With different implemented technologies, they can produce a variety of coatings and deposit complex layers. The coating units are ideally suited for the development of customized coatings and ensure that our customers can set themselves apart from their competitors by creating their own brand image. Furthermore, the Custom Coating Solutions division integrated into our dual business model gives us the flexibility to build customized PVD systems dedicated exclusively to a single customer, use or purpose.

Open-Source technologies inspire innovations. By purchasing our technology, customers can participate in our know-how. Our systems are open to engineers, their parameters and recipes can be changed and further developed if needed. We also value interactions, discussions and sharing knowledge with technology users, as we firmly believe that both parties benefit from transparency and openness.

We believe in **strong customer relationships,** ensuring our customers are always satisfied. We stand by our customers with worldwide service, support and sales offices as well as with our partners for upstream and downstream processes. Our customers benefit from our network, which matches supply with demand for tool manufacturers, regrinders and coating centers. As a premium provider, we can assist our customers in customer acquisition: we provide support from sampling to the adaption of coatings resulting in innovations. PLATIT does not offer job coating services and therefore avoids entering into competition with its customers.

About us

Milestones

Company

1947

Walter Blösch establishes W. Blösch AG as a company providing gold plating for watch cases and jewelry and manages the company until 1994

R&D

1993

PLATIT AG is founded

First PLATIT PVD hard coating unit: PL1000

1994

Peter and Erich Blösch take over the company as second-generation owners

1999

Founding of PLATIT Inc. in the US

2000

Market launch of PLATIT Turnkey Solutions

2001

Founding of PIVOT in a joint venture with SHM in the Czech Republic

2003

- First coating unit with rotating LARC® and nano-composite coatings: Pi80
- PL2001: Custom Coating Solution for saw blades

2004

First coating unit with plug-&-play functionality: PL1001

2005

First coating unit with LARC® and CERC®: Pi300

2009

Release of DLC2 (PECVD) processes (a-C:H:Si)

2010

Market launch of the PLATIT 11-Series with the Pi111

2011

Founding of PLATIT Advanced Coating Systems (Shanghai) Co., Ltd., in China

Introduction of LGD® etching technology

2012

Pi603: Custom Coating Solution for saw bands

2013

Formation of PLATIT a.s. in the Czech Republic by fully integrating PIVOT a.s. into PLATIT Group

Market launch of the Pi411 with SCIL®

2014

Market launch of the ultra-fast CT40 decoating system

2015

- Market launch of the Pi1511
- Introduction of the new PLATIT SmartSoftware

2016

Release of the new generation of the PL1011 High Volume Unit

2017

Integration of the custom-coating-systems engineering company PLANAR SA into PLATIT AG

Release of the new generation of the Pi411 with additional hybrid LACS® technology with simultaneous ARC and SPUTTER processes

2018

Management transition to the third generation of the family-owned company with Patrick, Pascale and Dominik Blösch

2019

Opening of CCS (Custom Coating Solutions) with a production site in Vaulruz, Switzerland

- Market launch of the PL711
- S-MPuls: Custom Coating Solution for coin minting

2020

- Release of ta-C coatings in Pi411
- PL2011: Custom Coating Solution for saw blades
- Mega-PiMS: Custom Coating Solution for rollers and broaches
- Release of the new generation of the Pi111 Smart Speed Unit

2021

Release of the new generation of the PL1011 with Plasma-Nitriding and Double-Pulsed features

2022

- Release of 3D etch indicator
- Release of the Omnis coating

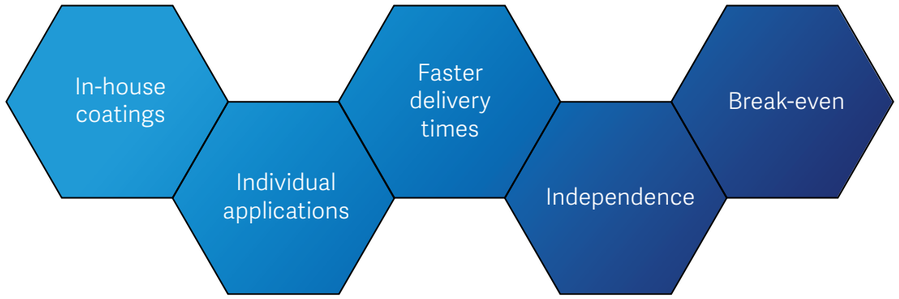
2023

- Release of the TiBor coating
- Release of the TapCT coating

Benefits of PLATIT solutions

The turnkey solutions from PLATIT are ideally suited for a seamless integration into the tool manufacturing and regrinding process.

For coating centers, PLATIT provides solutions that meet the various challenges of their customers.



In-house PLATIT units for tool manufacturers and regrinders

The integration of coating units into the in-house tool manufacturing or regrinding process offers a variety of advantages:

- **Independence:** with your own turnkey system, the entire production is in your own hands. There are no dependencies or risks on the supply chain.
- **Faster delivery times:** in-house processes allow production, grinding and coating to take place on the same day, ensuring the shortest possible routes and preventing transport damage.
- **Coating know-how for individual applications:** a coating center mixes different tools; processes are designed for general use, not specifically for individual applications. In-house, coating thickness and quality can be adapted and controlled.
- **Dedicated Coatings:** PLATIT's open-source technology, which makes it possible for customers to develop their own coatings, guarantees the potential for differentiation from the competition.

Especially tool manufacturers with a high demand for the latest technologies and innovative PVD coatings benefit from the properties of PLATIT's Pi technology in terms of a unique competitive advantage.

As a manufacturer or regrinder you are focused on producing the best tools or components for your markets, where competition is continuously getting stronger. You have already considered investing in a high-tech PVD coating system to get your tailored high-performance PVD coatings, but besides the tough choice of picking the right technology, you ask yourself how coating your tools and components in-house pays off in comparison to continuing to use job coating services.

To assist you with this comparison, we provide you the table and graph with examples of an US SME producing 3/8" x 3" shank tools and using two coatings – Omnis and nACo. We show a monthly cost comparison between using job coating services and an in-house PLATIT PVD coating system.

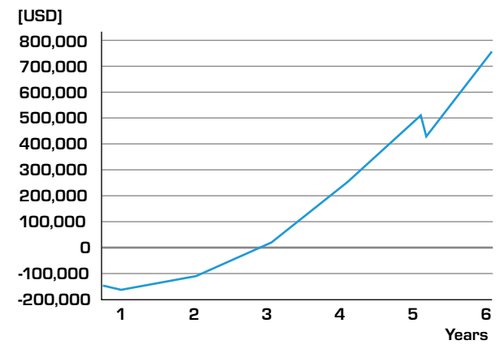
External job coating costs are based on market prices in US and complemented by costs for internal resources needed for order processing and logistics. For the in-house PLATIT coating system, the investments are calculated including the required peripherical devices such as a chiller, a cleaning system and quality control (USD 790,000), financed by leasing (5 years, 20 % down payment, 15 % residual value); salaries, rent, maintenance, energy and consumables (incl. gas, targets, water, and cleaning solution).

Cashflow USD / month	Pi111 PLUS G3				
	Year 1 / per month 2,268 tools / month	Year 2 / per month 4,470 tools / month	Year 5 / per month 10,560 tools / month	Year 6 / per month 10,560 tools / month	Accumulated Total Cashflow for Year 1–6
Job coating spendings	10,410	19,149	38,776	38,776	2,020,804
Internal wages logistics	618	1,104	2,208	2,208	113,403
Total job coating cashflow	**11,028**	**20,253**	**40,984**	**40,984**	**2,134,207**
Leasing	10,466	10,466	10,466	leasing fully paid	627,960
Space rent	426	426	426	426	30,679
Salaries	1,236	2,208	4,416	4,416	226,806
Maintenance & wear parts	118	420	1,080	1,320	52,771
Targets	290	1,036	2,071	2,071	102,891
Other var. costs	241	431	862	862	44,270
Total in-house cashflow	**12,777**	**14,921**	**19,321**	**9,095**	**1,085,377**
Down-/final payment					276,500
Delta job coating vs. in-house coating	**- 1,749**	**+ 5,333**	**+ 21,663**	**+ 31,889**	**+ 772,300**

This cost comparison reinforces the following statements:

- If you are spending around USD 125,000 annually on job coating, an investment in an in-house PVD system should be your next step
- Investing in PVD technology already generates a positive cash flow shortly after the investment
- After about 2.5 years, the accumulated positive cashflow surpasses the initial investment
- Cash is invested in the company's assets by growing its machine park and is not lost in spending for external job coating service
- Over a six years period, there is the potential to generate a cash surplus of > USD 750,000 in addition to growing the company's assets

Cumulative cashflow in USD: Job coating vs. in-house coating



Detailed case description:
US SME: tool manufacturer, 3/8" x 3" shank tools, Omnis & nACo, max. 208 tools / batch (kicker-system). Year 1 = 17 batch / month; year 5 = 60 batch / month
Costs included: Investment costs for turnkey system including chiller, cleaning system and quality control (USD 790,000), financed by leasing (5 years, 20 % down payment, 15 % residual value); salaries, rent, maintenance, energy and consumables (incl. gas, targets, water, and cleaning solution)

Benefits of PLATIT solutions

PLATIT units for coating centers

Coating centers have different demands regarding a PVD coating system than tool manufacturers or regrinders. Example requirements are listed below:

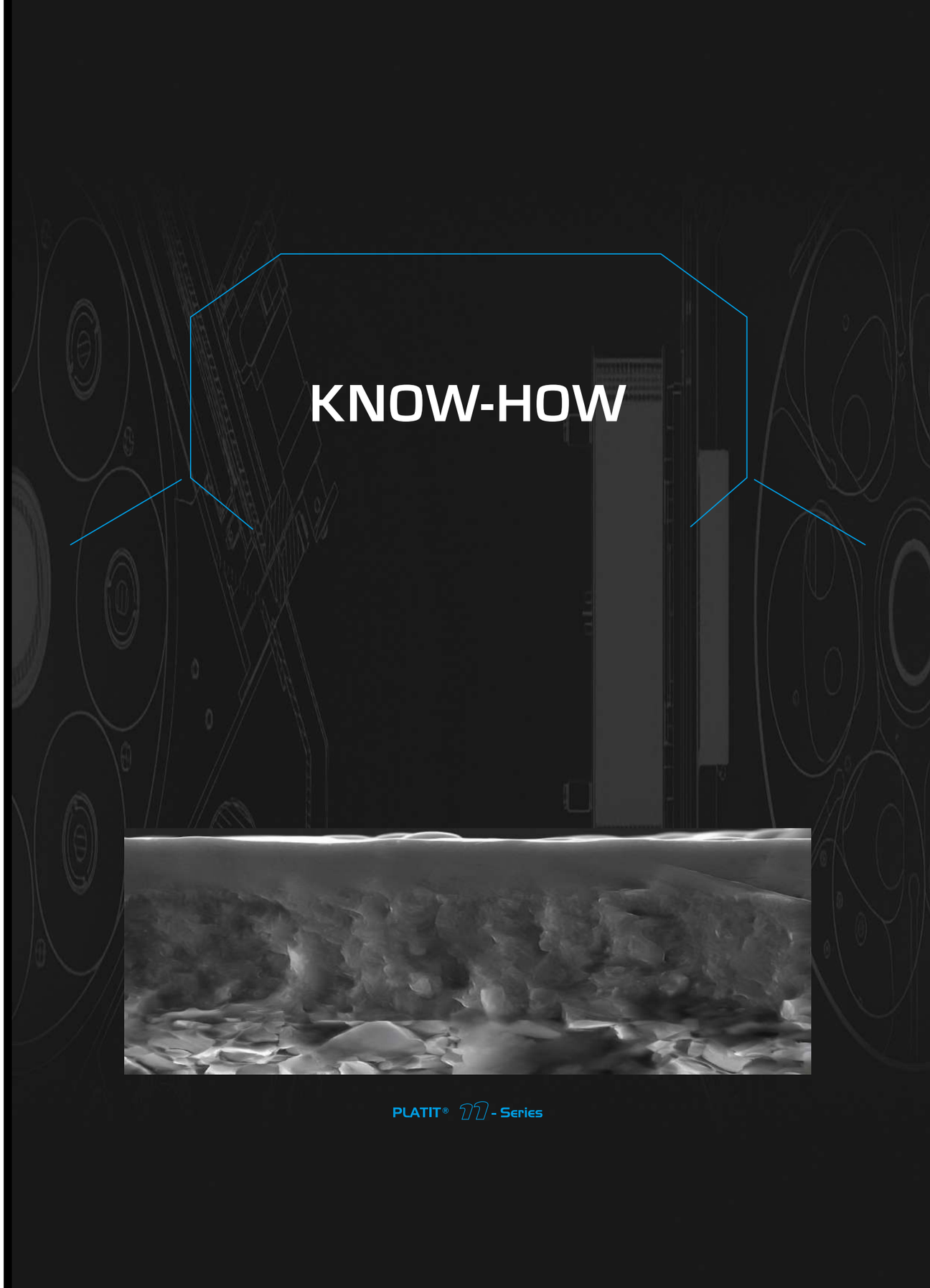
- **Flexibility:** PLATIT standard and custom coating solutions can be programmed with different coating technologies. The systems can deposit PVD and PECVD for various nitride, oxide and DLC coatings without needing to change the targets. True to the open-source approach, they are suited for the development of Dedicated Coatings.
- **High-quality coatings:** in depositing coatings, PLATIT units combine high performance with very short cycle times.
- **Partnerships:** PLATIT attaches great importance to strategic partnerships, as both parties benefit from sharing knowledge, and therefore supports coating centers from sampling to the adaptation of coatings. With worldwide service, support and sales offices as well as a network for upstream and downstream processes, PLATIT always stands by its customers.
- **Customer acquisition:** as a premium supplier, PLATIT can assist coating centers in customer acquisi¬tion and bring together supply and demand.
- **No competition:** to PLATIT, it is very important that there is no competition with its own customers. For this reason, it has and will not set up any coating centers in its target markets.

Strengths of PL1011

Our high-volume coating unit PL1011 is especially suited for coating centers. The PL1011 enables coating centers to meet the high-quality demands of their customers. The planar targets, which are considered standard on the market, guarantee a cost-efficient coating.

PL1011:

- Four Planar ARC cathodes, considered standard in the PVD world
- Low costs per tool
- For coating large quantities of different tools
- Suitable for a wide range of application



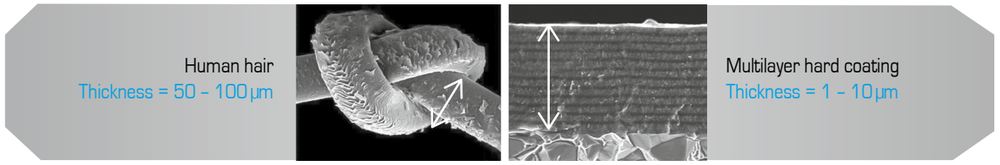
PVD hard coating

A coating is a thin protective film intended to improve the surface properties of a base material in terms of:

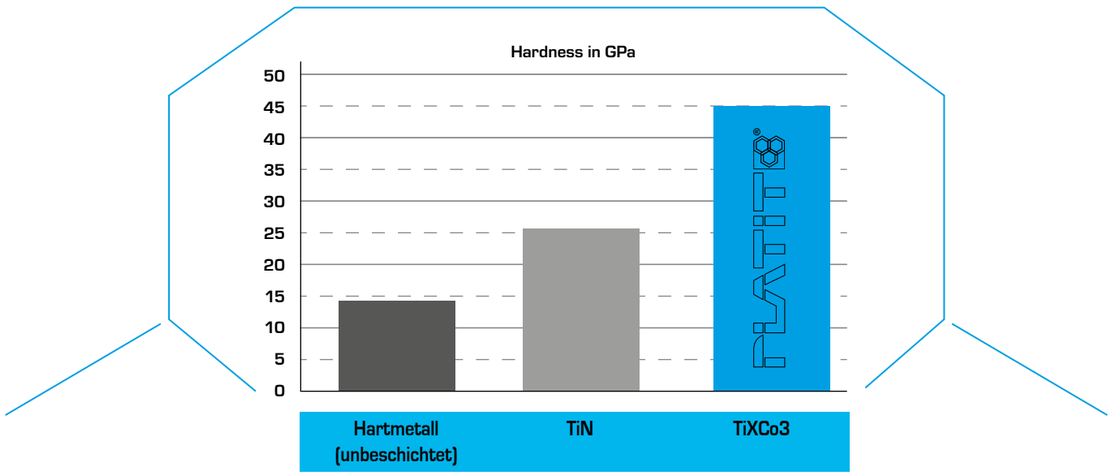
- Hardness
- Oxidation resistance
- Friction
- Fracture toughness
- Chemical stability
- and many other properties depending on the applications

With just a few microns, the coating on a cutting tool allows for example for faster cutting speeds, resulting in higher productivity and a longer lifespan of the base material.

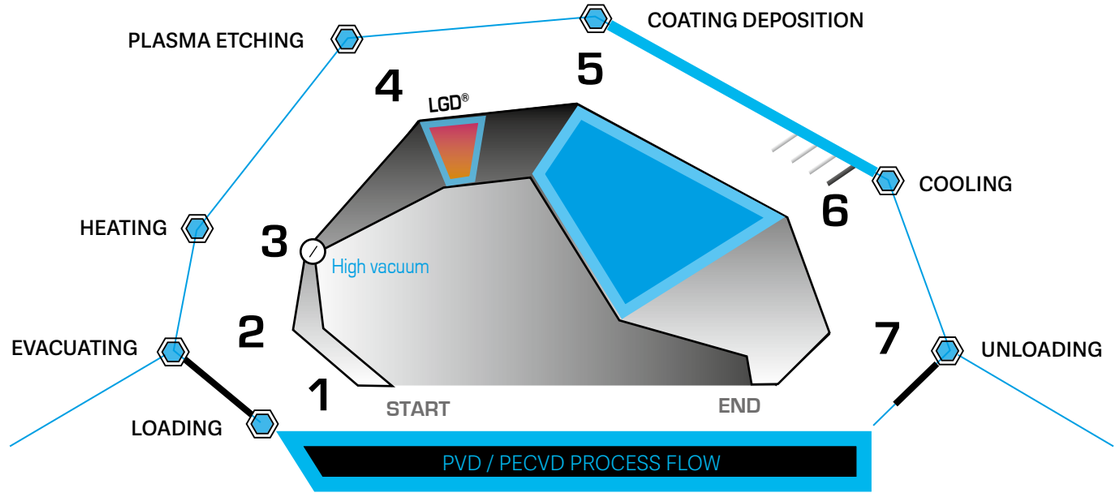
Comparison between a human hair and hard coating:



Comparison of hardness from the softest to the hardest material:



Coating process



1. **Loading**
   The coating chamber is loaded

2. **Evacuating**
   A high vacuum is required for depositing PVD coatings. The evacuation in PLATIT coating units takes place in two steps:
   2.1 The rotary-vane pump generates an inlet pressure in the chamber from 100 to 10^{-2} mbar
   2.2 The turbomolecular pump generates a high vacuum of approximately 1×10^{-5} mbar

3. **Heating**
   The chamber is heated up. Process temperatures are about 150–500 °C

4. **Plasma etching**
   PLATIT coating units work with three different etching processes:
   - LGD® (Lateral Glow Discharge)
   - Plasma etching with argon, glow discharge
   - Metal ion etching (Ti, Cr)

5. **Coating deposition**
   Coating deposition with PVD (ARC, SPUTTER or hybrid LACS® technology) or PECVD processes

6. **Cooling**
   Cooling of the coating chamber

7. **Unloading**
   The coating chamber is unloaded

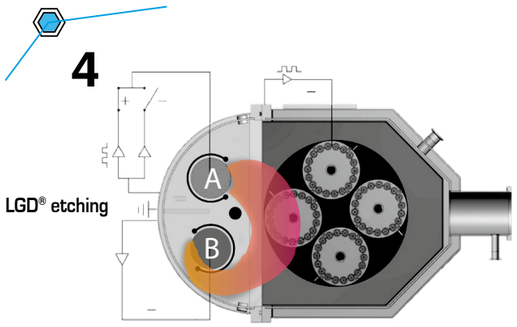
Coating process

LGD® etching

LGD® (Lateral Glow Discharge) is the patented etching process in PLATIT's coating units. It takes place before the coating process. Thanks to plasma with high ion density generated by an electron flow between two cathodes, LGD® can process even complex surfaces and cavities as well as cutting-edges (e.g. of hobs, molds and dies).

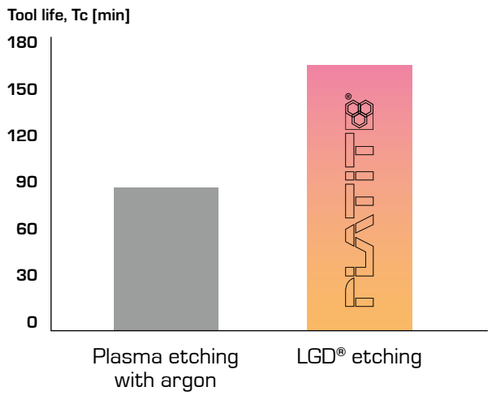
Highlights:
- Low antenna effect due to low bias voltage
- Increased mean free path
- Better etching penetration → improved etching of flutes

Plasma etching:



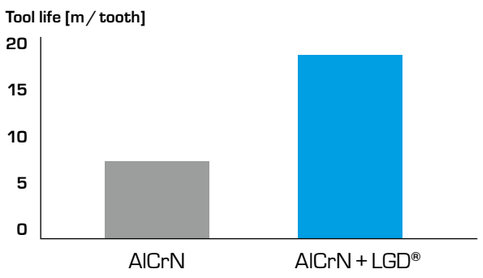
Use of shutters:
- Targets are cleaned by igniting an ARC behind the shutter on the target surface without contaminating the tools
- The shutter is opened after the cleaning process of the target, which creates ideal conditions for optimal coating adhesion

Comparison of different etching methods:



Tool: milling head; insert ADMX 11T308SR; z = 4
Cooling with emulsion; ap = 8 mm; ae = 22 mm; vc= 80 m / min; f = 0.1 mm / rot
TiAlN1x with LGD® and 1 × plasma etching with argon

Increased tool life by LGD® at hobbing



Tool: PM-HSS
Workpiece material: 20 MnCrB5
Module: 2.7 mm; downhill milling; dry
vc = 220 m / min; fa = 3.6 mm / rot
Source: 2-tooth test at the University Magdeburg, Germany

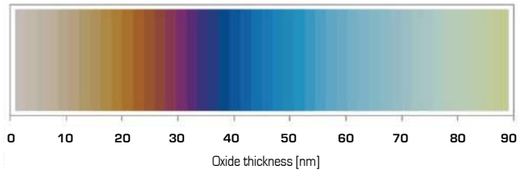
3D etch indicator

Our patented 3D etch indicator is a method for visual observation of the plasma etching efficiency and quantification thereof. It allows dedicated processes and parameters for shank tools, gear cutting tools, dies or even for complex geometries.

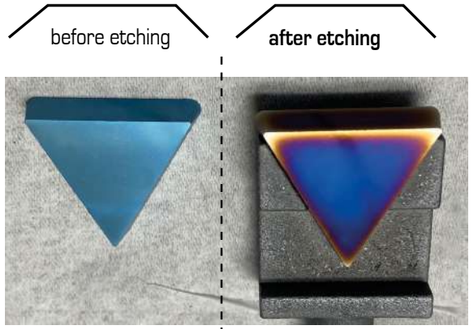
Highlights:
- Provides a 3D profile of the plasma etching efficiency
- Prevents both, insufficient etching and over-etching
- Boosts the performance of coatings in targeted applications

To obtain a 3D etch profile, the tools are covered with thin films reflecting homogenously a single interference color (e.g., blue). The plasma etching procedure will be carried out. In accordance with interference colors scale [1], observed color changes over etched surfaces depict etching efficiency on each of them. Therefore, a complete 3D etch profile over the substrate with a high resolution (± 5 nm) is generated.

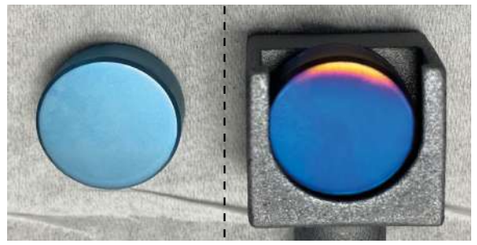
PLATIT's 3D plasma etch indicator enables to select the right combination of etching technologies as well as the parameters and ensures that the selected etching strategy leads to optimum material removal from the substrate surface. While conventional optimization of plasma etching is only feasible for 1D or 2D measurements and requires feedback from performance tests, with the 3D etch indicator, feedback is visible to the naked eye immediately after the plasma etch test.



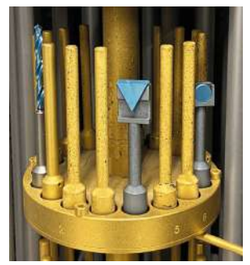
Interference color scale from [1] Antończak, A. J., et al. (2014). The influence of process parameters on the laser-induced coloring of titanium. Applied Physics A, 115(3),1003–1013



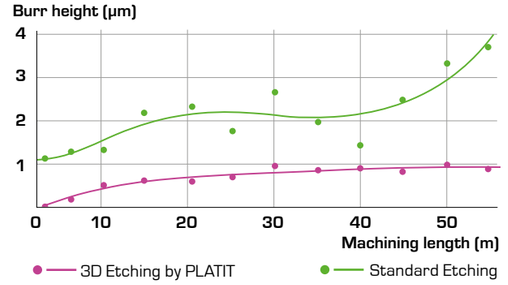
3D Etching by PLATIT®



Inhomogeneous removed material



Burr height (µm)



The graph shows the result of a dedicated etching optimization: the burr height of the micro tool coating with optimized etching is much lower compared to the standard plasma etching.

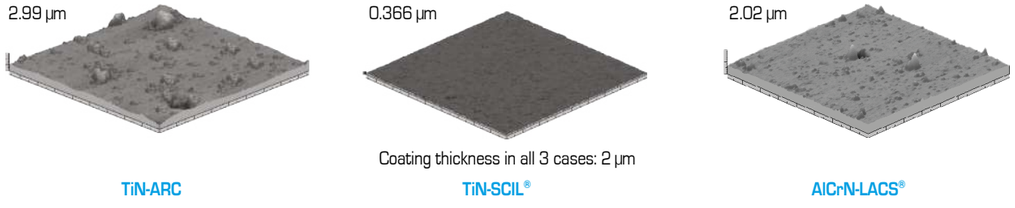
Coating technologies

Comparison

Coatings are usually deposited using ARC or SPUTTER technology. PLATIT hybrid LACS® additionally offers a fusion of technologies unique in the coating world.

ARC technology	SPUTTER technology	Simultaneous ARC and SPUTTER processes
Common way of coating cutting and forming tools	Common for decorative coatings and micro-tools	PLATIT's patented hybrid LACS® technology combines the advantages of LARC® cathodes with those of central SPUTTERING SCIL®
With ARC technology, primarily conductive materials such as metals are used as targets	Targets with low thermal conductivity such as pure ceramics can also be SPUTTERED	Introduction of "new" materials through the SPUTTERING of ceramics
High degree of ionization	Low degree of ionization	High degree of ionization
Excellent adhesion	Improved adhesion through SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge) or through SPUTTERING in PL711	Excellent adhesion
High deposition rate	High deposition rate thanks to SCIL® of 2 µm / h with 2-fold rotation	Higher deposition rate than with SPUTTERING only, but lower than with ARC only, up to 3 µm / h with 2-fold rotation
Droplets increase surface roughness (Sa ~ 0.2 µm; Sz ~ 2.1 µm)	Smooth surface free of droplets and defects (Sa ~ 0.02 µm; Sz ~ 0.3 µm)	Superior surface quality compared to ARC (Sa ~ 0.1 µm; Sz ~ 1.6 µm)

Comparison of the surface:

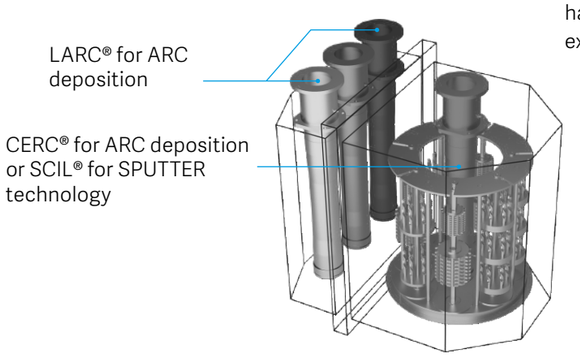


ARC with rotating cathodes

LARC® and CERC® are PLATIT's trademarked brand names for rotating cylindrical cathodes inside the door and at the center of the coating chamber using ARC technology for deposition.

The working principle of all PLATIT's Pi coating units is based on the revolutionary LARC® cathodes (LAteral Rotating Cathode) from the door of the coating chamber.

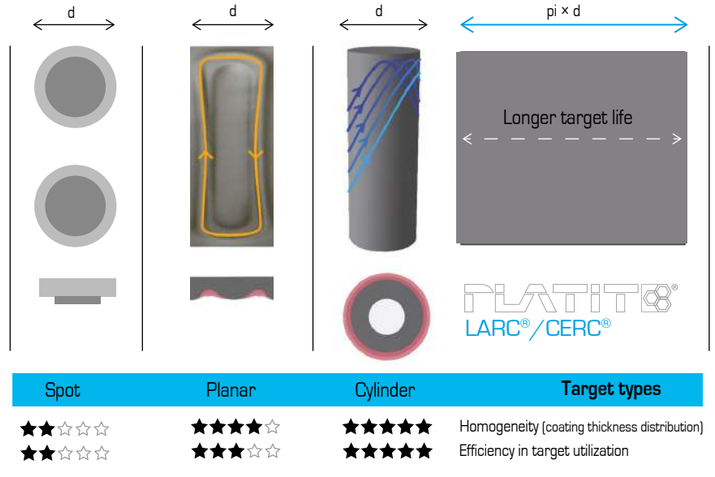
The Pi411 is upgradable with a CERC® (Central Rotating Cathode).



Compared to conventional cathodes, rotating cathodes have several advantages:

- Flexibility in programming the coating composition of unalloyed targets
- A larger effective target surface area (pi × d) at a constant target length h (pi × d × h) prolongs target lifetime (please see the target performance comparison below)
- Excellent process control and stability
- Improved coating adhesion through LGD® etching (Lateral Glow Discharge)
- Homogeneous vertical coating thickness distribution in the chamber
- All the rotating cathodes in PLATIT's Pi coating units have a lifetime warranty when regularly exchanged in PLATIT Cathode Exchange Centers

Target performance comparison:

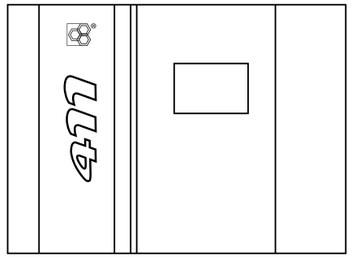


Coating technologies

Hybrid LACS® technology

Hybrid LACS® technology (LAteral ARC with Central SPUTTERING) with simultaneous ARC and SPUTTER processes combines the advantages of LARC® cathodes with those of central SPUTTERING SCIL®:

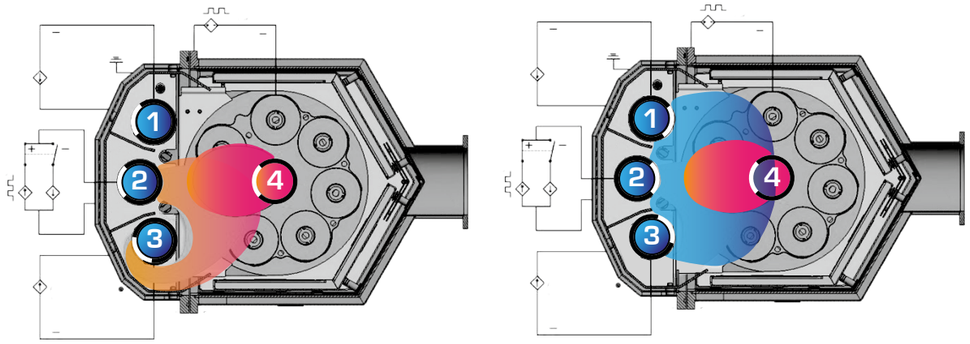
- High ion density, excellent adhesion
- High deposition rates
- Possibility to dope ARC coatings by SPUTTERING e.g., ceramic or non-conductive materials
- Smoother coatings

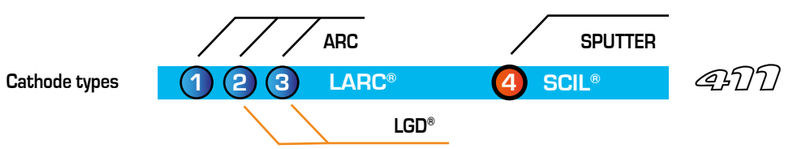


Two types of hybrid technology available in Pi411

Simultaneous deposition by LGD® (Lateral Glow Discharge) **& SCIL®** (SPUTTERED Coating Induced by Lateral Glow Discharge) to increase ion density and affect the coating properties of SPUTTER coatings.

Simultaneous deposition by LARC® (LAteral Rotating Cathode) **& SCIL®** with the combination of ARC evaporation and SPUTTERING for targeted doping of coating components.





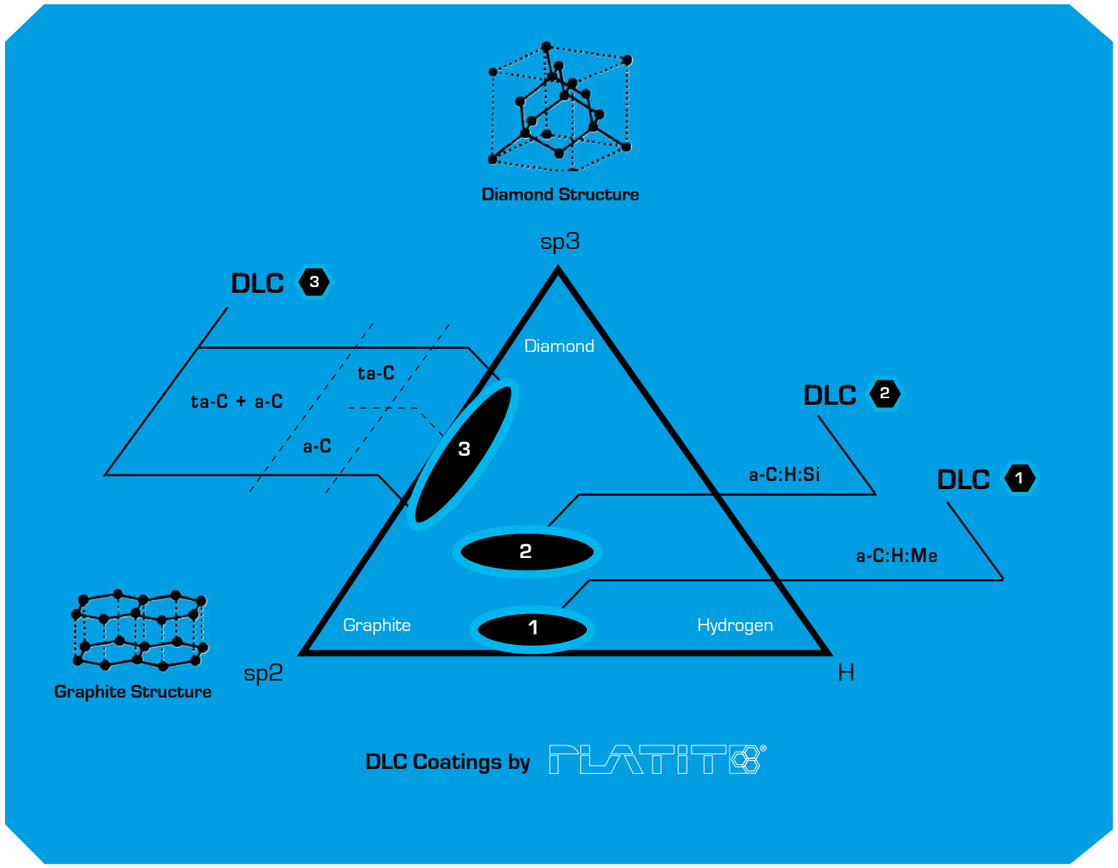
DLC coatings

DLC (diamond-like carbon) is a metastable form of diamond-like amorphous carbon with a significant amount of sp3 bonds.

The higher sp3 bond fraction results in a higher density, hardness (at ambient and elevated temperature), thermal stability, oxidation resistance, higher residual stress and lower thermal conductivity.

Properties and application possibilities:

- Smooth surface
- High mechanical hardness
- Chemical resistance
- Lowest coefficient of friction between the tool and the workpiece
- Good corrosion resistance
- Non-reflective surface
- Suitability for biocompatible products



DLC coatings

DLC coatings are divided into the following categories:

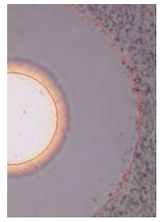
- a-C = hydrogen-free amorphous carbon
- ta-C = tetrahedrally bound hydrogen-free amorphous carbon
- a-C:Me = metal-doped hydrogen-free amorphous carbon (Me = Ti)
- a-C:H = amorphous carbon with hydrogen
- ta-C:H = tetrahedrally bound amorphous carbon with hydrogen
- a-C:H:Si = Si-doped amorphous carbon with hydrogen
- a-C:H:Me = metal-doped amorphous carbon with hydrogen (Me = W, Ti)

Comparison of the most important properties of PLATIT DLC coatings

	DLC 1	DLC 2	DLC 3
PLATIT coating unit	Pi111 Pi411 PL1011	Pi411 PL711 PL1011	Pi411
Composition	a-C:H:Me	a-C:H:Si	ta-C + a-C (over 50 % ta-C)
Process	ARC in C_2H_2 atmosphere	PECVD	SPUTTERING
Coating architecture	As top layer	As stand-alone or as top layer	As stand-alone
Doping	Ti or Cr	Si	None
Coating thickness [µm]	< 1*	< 3	0.3–1
Young's modulus [GPa]	200*	250	350–450
Nano-hardness [GPa]	< 20*	> 25	35–55
Roughness	Ra ~ 0.1 µm* Rz ~ coating thickness*	Ra ~ 0.03 µm Rz ~ coating thickness	Ra ~ 0.06 µm Rz ~ coating thickness
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	~ 0.15*	~ 0.1–0.2	~ 0.1
Max. service temperature [°C]	400	400	450
Coating temperature [°C]	< 400	< 220	< 100
Main application	Improvement of the run-in proces of a tool, lubrication by formation of transfer films	Components, punches and dies	Tools

* As a top layer

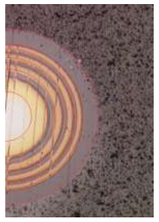
Coating structures



Monoblock (MB) consists of a single layer of nitride. This single layer can be applied on an adhesion layer (e.g. TiN + AlTiN-MB). If the adhesion layer and monoblock do not differ, the coating process does not switch between different target materials.

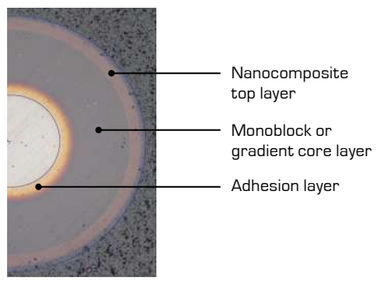
Gradient structure (G) occurs if the composition in the coating continuously changes. The coating consists of an adhesion and a core layer. A typical G coating is TiAlN / AlTiN-G.

Nanolayer (NL) is a finer version of a multilayer with a layer thickness of < 20 nm. Coating hardness depends on the coating thickness period. To increase the hardness, a period of approx. 10 nm should be set. All PLATIT coatings with metallic targets have a NL structure.

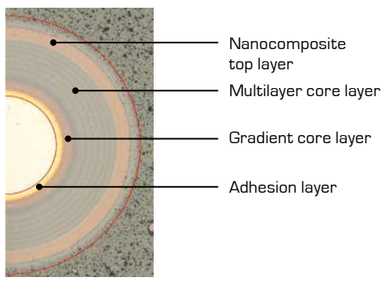


Multilayer (ML) also consists of an adhesion and a core layer. After the adhesion layer, several (multiple) layers are deposited in succession. These multiple layers create a sandwich structure that absorbs the cracks in the sublayers. The coating is tougher but not as hard as a monoblock. The thickness of a single layer in ML is typically 50–100 nm, as for example in AlCrN-ML.

Nanocomposites (NC) consist of an adhesion and a core layer. The core layer consists of 2 phases: hard, nanocrystalline grains (e.g. TiN, TiAlN or AlCrN grains) are embedded in an amorphous SiN matrix, which prevents the grain from growing and creates the nanocomposite structure. Column growth is prevented and a fine crystalline / amorphous structure is formed. One example is nACo.



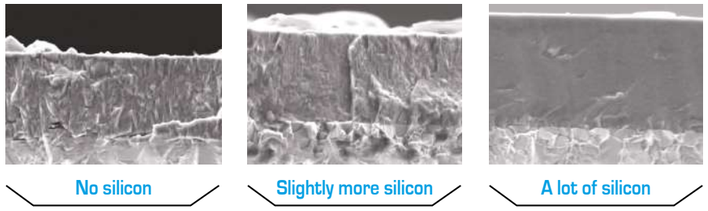
TripleCoatings3 from PLATIT consist of an adhesion layer, a core layer (MB or G) and a nanocomposite top layer. A typical coating is nACo, available with the Pi411 coating unit.



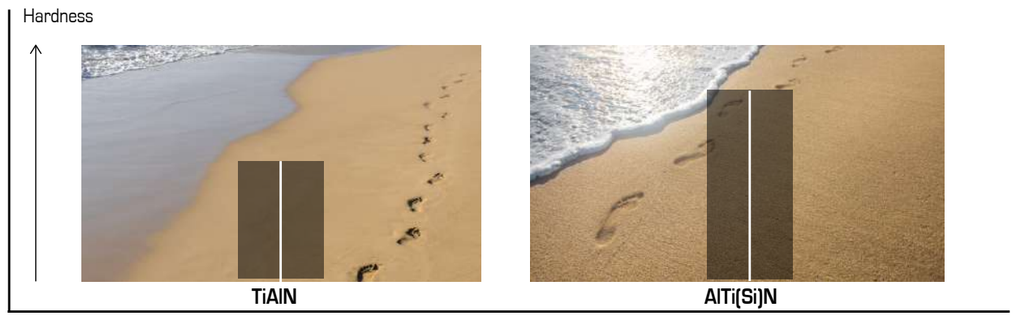
QuadCoatings4 from PLATIT receive a fourth block for special purposes in addition to the triple structure. These coatings consist of an adhesion layer, a first core layer of the gradient type, a second core layer of the multilayer type and a nanocomposite top layer. A typical example is TiXCo4.

Coating structures

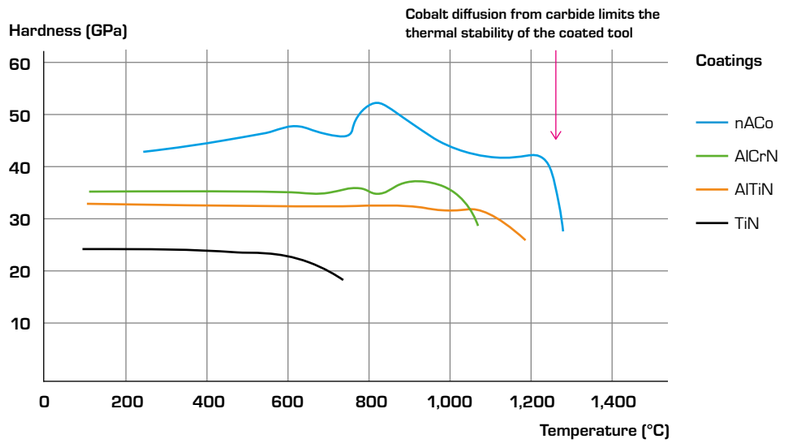
Comparison of the structure



A comparison with sand on a beach can serve to illustrate the increase in hardness achieved by the nanocomposite structure: normally, a person's foot will sink into dry sand. If the sand is wet, their foot will not sink in as far, because the space between the grains is filled with water. The surface has a higher resistance and is therefore harder.



Heat resistance comparison of nanocomposite:



Standard coating units

PLATIT 11-Series overview

PLATIT offers high-tech PVD and PECVD coating units. Depending on the requirements, we equip them with the following technologies:

- ARC in DC or pulsed mode
- SPUTTER in DC, pulsed or HiPIMS mode
- Hybrid technology with simultaneous ARC and SPUTTER processes

PVD standard coating units from PLATIT are perfectly suited for coating tools and components of standard market sizes. They allow for short cycle times with high-quality coatings and can be flexibly programmed with different coating structures.
Standard coating units can deposit PVD and PECVD for various nitride, oxide and DLC coatings.

PLATIT® 11 - Series

	Pi111	Pi411	PL711	PL1011
Max. coating volume [mm]	ø 353 × H 498	ø 540 × H 500	ø 600 × H 805	ø 715 × H 805
Max. load [kg]	160	200	250, higher weight upon request	750
Load and cycle times of shank tools (2 µm): ø 8 × 70 [mm]*	288 pcs., 4–5 h	504 pcs., 5–6 h	540 pcs., 10 h	1,008 pcs., 7–8 h
ARC technology	2 × LARC® PLUS cathode	3 × LARC® cathode, upgradable with 1 × CERC® cathode	-	4 × Planar cathode, upgradable for Double-Pulsed feature
SPUTTER technology	-	Upgradable with 1 × central SCIL® cathode	2 × Planar cathode	-
Hybrid-LACS® technology with simultaneous ARC & SPUTTER processes	-	Yes, upgradable	-	-
DLC	Upgradable for DLC1 with TiCN option	DLC1, upgradable for PECVD (DLC2) and for ta-C sputtered (DLC3)	PECVD (DLC2)	DLC1, upgradable for PECVD (DLC2)
OXI	-	Upgradable for oxide coatings	-	-
Nitriding	-	-	-	Yes, upgradable

* Average cycle times in an ongoing production with max. number of cathodes in use.

111

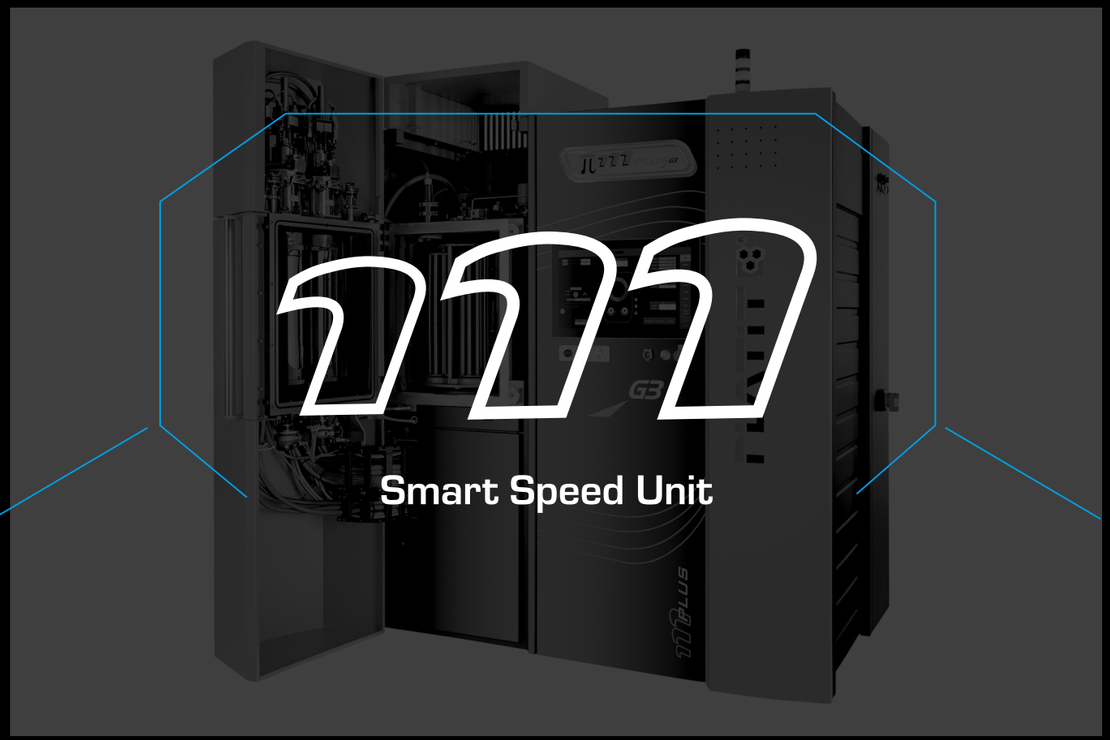
411

PLATIT® 11 - Series

211

1011

1511

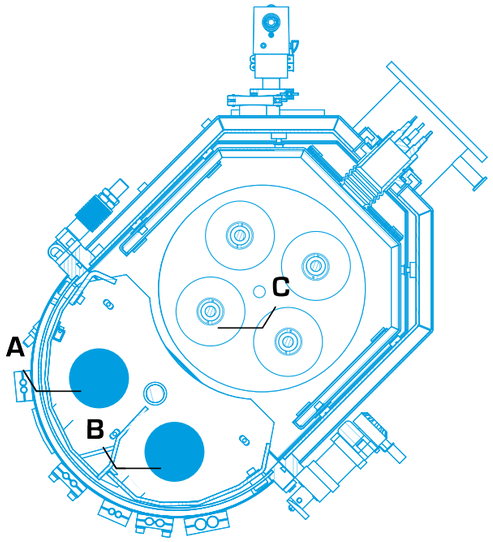


AR

PLATIT® 11 - Series

111 Smart Speed Unit

A LARC® PLUS Cathode
B LARC® PLUS Cathode
C Carousel



Smart Easy Fast

The Pi111 PLUS G3 represents the third generation of a compact PVD coating unit from PLATIT. Its key features are fast cycle times, easy operation and user-friendliness at a favorable price – without compromising coating performance. Having two rotating cathodes utilizing ARC technology, the unit deposits selected PLATIT Signature Coatings at a consistently high level of quality. It is the ideal choice for customers looking to enter the coating world or wanting to add a fast low-volume PVD system to their fleet of machines.

Technologies applied:
- 2 × LARC® PLUS (LAteral Rotating PLUS Cathode) for ARC deposition

Advantages of LARC® PLUS compared to LARC®:
- Improved target utilization (up to 30 %)
- Enhanced magnetic-field system, thus increased deposition rate
- Quick cathode exchange

PLATIT®

Targets	Signature	Cycle	Max. Load	Solution	Service
2	Coatings	≥ 4 h	160 kg	Turnkey	Worldwide

111 Smart Speed Unit

Specifications

Etching technologies applied:
- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:
- Max. coating volume: 353 × H 498 [mm]
- Max. coating height with defined coating thickness: 414 mm
- Max. load: 160 kg

4–5 batches / day for*:			
Shank tools (2 µm):	ø 8 × 70 [mm]	288 pcs.	4–5 h
Inserts (3 µm):	ø 12 × 4 [mm]	2736 pcs.	5–6 h
Hobs (4 µm):	ø 80 × 180 [mm]	8 pcs.	6–7 h
Hobs (4 µm):	ø 75 × 100 [mm]	40 pcs.	6–7 h

* Average cycle times in an ongoing production with max. number of cathodes in use.

Modular carousel systems:
- Dual-rotation kicker carousel or triple-rotation gearbox system

Software:
- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

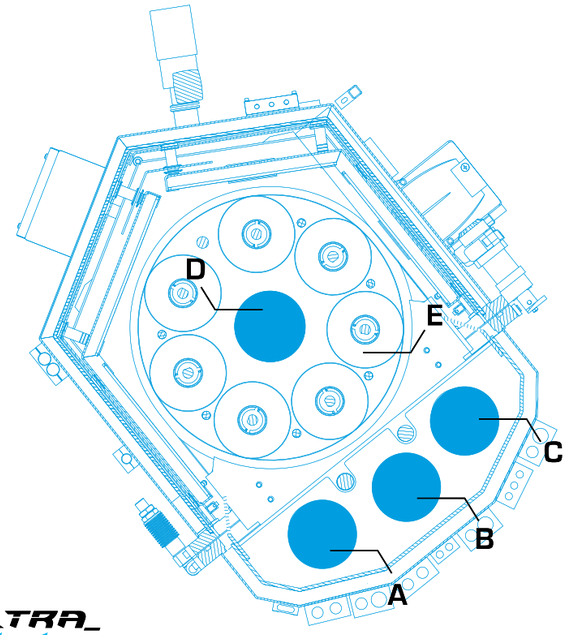
Machine dimensions:
- Footprint: W 2,000 × D 1,550 × H 2,250 [mm]

AR

PLATIT® π - Series

411 Ultra Flexible Unit

The broad variety of configuration options as well as the flexibility made possible by the rotating cathodes allows for the development of customer-specific top-performance coatings. Thus, this coating unit addresses the needs of customers who are seeking maximum flexibility with a full range of coating technologies easily accessible in one machine.



A LARC® Cathode
B LARC® Cathode
C LARC® Cathode
D CERC®/SCIL® Cathode
E Carousel

411 ULTRA Flexible

Modular HiEnd Hybrid

Due to its modular design and the range of available technologies, the Pi411 PLUS is the world's most flexible coating unit. Its basic configuration as an ARC unit with three rotating cathodes inside the door can be modularly upgraded on-site with an ARC or SPUTTER central cathode as well as with PECVD and OXI processes. Unique to this unit is also the availability of LACS® hybrid technology, which allows for the simultaneous deposition of coatings using both ARC and SPUTTER technology.

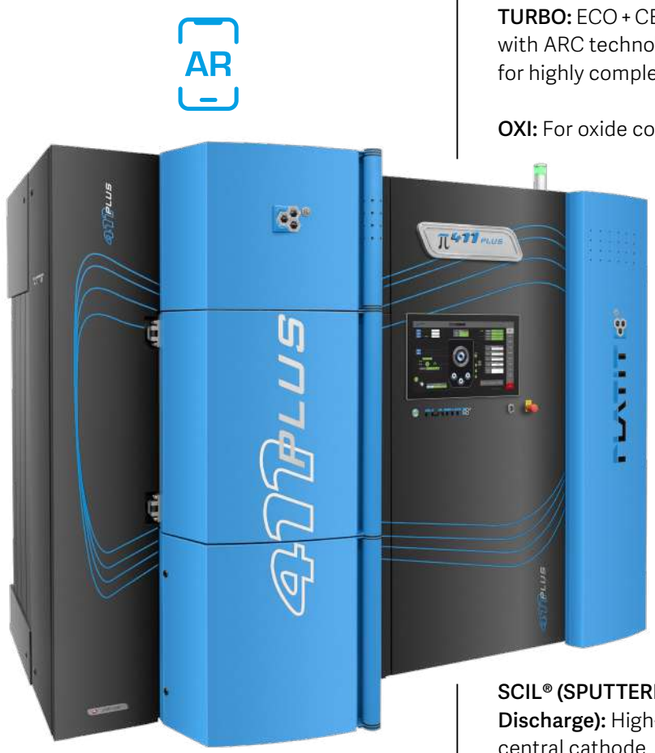
Options for Pi411 PLUS

ECO: Basic configuration with 3 × LARC® (LAteral Rotating Cathode) inside the door for ARC deposition

PECVD (DLC2): For a-C:H:Si coatings

TURBO: ECO + CERC® (Central Rotating Cathode) with ARC technology to increase productivity and allow for highly complex coatings

OXI: For oxide coatings in a corundum structure



SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge): High-performance SPUTTERING from the central cathode

Hybrid LACS®: Simultaneous ARC and SPUTTER processes with LARC® inside the door and a central SCIL® cathode

Targets	Hybrid	Signature	Cycle	Max. Load	Solution	Service
3 – 4	LACS®	Coatings	≥ 5 h	200 kg	Turnkey	Worldwide

411 Ultra Flexible Unit

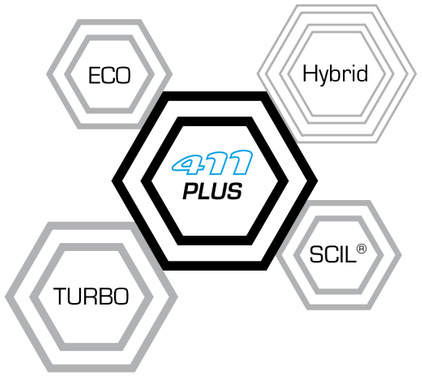
Sample cathode configurations

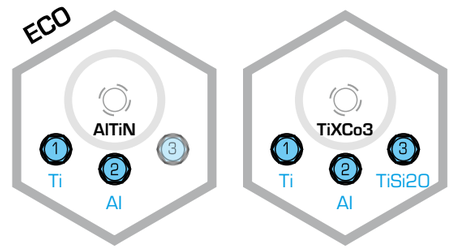
ECO

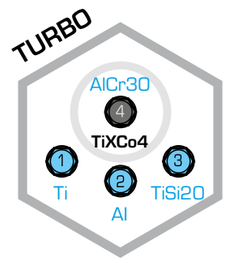
TURBO

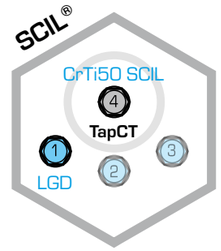
SCIL®

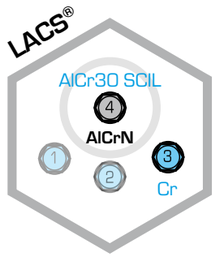
HYBRID











ULTRA Flexible

411 Ultra Flexible Unit

Specifications

Etching technologies applied:
- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:
- Max. coating volume: ø 540 × H 500 [mm]
- Max. coating height with defined coating thickness: 414 mm
- Max. load: 200 kg

4–5 batches / day for*:			
Shank tools (2 µm):	ø 8 × 70 [mm]	504 pcs.	5–6 h
Inserts (3 µm):	ø 12 × 4 [mm]	4,788 pcs.	6–7 h
Hobs (4 µm):	ø 80 × 180 [mm]	14 pcs.	7–8 h
Hobs (4 µm):	ø 80 × 100 [mm]	56 pcs.	7–8 h

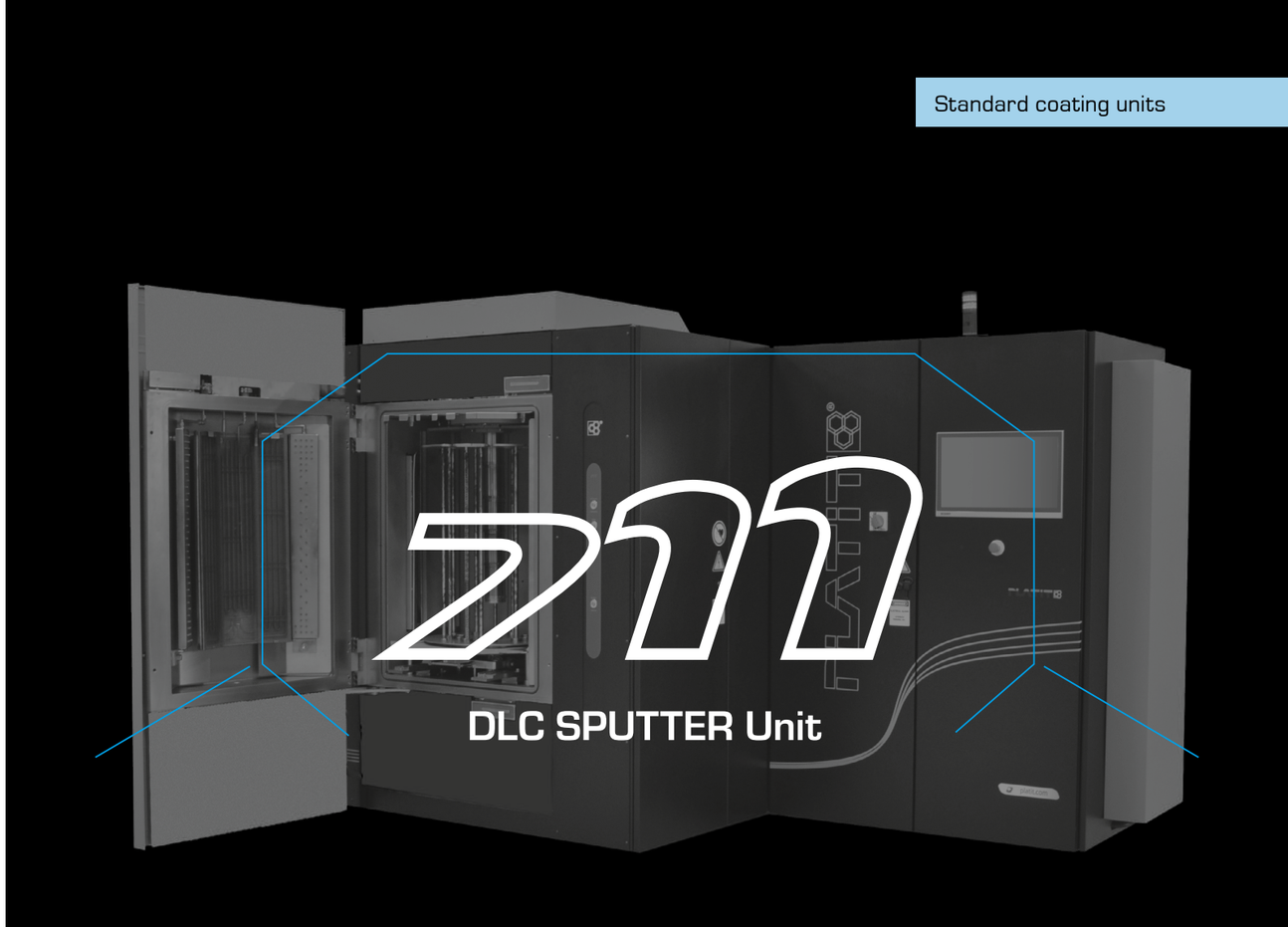
* Average cycle times in an ongoing production with max. number of cathodes in use.

Modular carousel systems:
- 1 to 14 axes

Software:
- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:
- Footprint: W 2,950 × D 1,900 × H 2,400 [mm]

Standard coating units

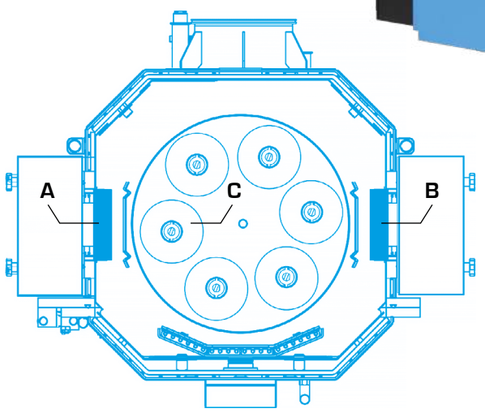


AR

PLATIT® 11 - Series

711 DLC SPUTTER Unit

A Planar SPUTTER Cathode
B Planar SPUTTER Cathode
C Carousel



Low TP DLC SPUTTER

The PL711 is a compact SPUTTER coating unit based on HiPIMS technology (High Power Impulse Magnetron SPUTTERING).
It's equipped with two Planar HiPIMS cathodes and allows for the deposition ofselected nitride as well as carbon-based coatings (DLC2) using highly productive processes.

Technologies applied:

- 2 × Planar SPUTTER cathode with HiPIMS technology
- Dense plasma with a high ionization degree in the carousel generates homogeneous coatings and reaches a high deposition rate. Coatings from the PL711 provide outstandingly smooth surfaces with a high density, hardness and excellent adhesion.

AR

Targets	Signature	Cycle	Max. Load	Solution	Service
2	Coatings	≥ 8.5 h	250 kg	Turnkey	Worldwide

711 DLC SPUTTER Unit

Specifications

Etching technologies applied:
- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Deposition types:
- SPUTTER nitride coatings
  - Reactive and non-reactive processes
  - Targets: Ti, Cr
  - Coating temperature up to 350°C

- SPUTTER Cr and PECVD a-C:H:Si
  - DLC2 (PECVD)
  - Targets: Cr
  - Coating temperature: 180 - 220 [°C]

Load and cycle times:
- Max. coating volume: ø 600 × H 805 [mm]
- Max. coating height with defined coating thickness: 500 mm
- Max. load: 250 kg, higher weight upon request

2 batches / day for*:

Shank tools (2 µm):	ø 8 × 70 [mm]	DLC2	540 pcs.	8.5 h
Molds and dies (3 µm):	≤ ø150 x 150 [mm]	CrN	12 pcs.	12 h
Sliding mold inserts (3 µm):	25 × 150 × 10 [mm]	DLC2	72 pcs.	9 – 10 h

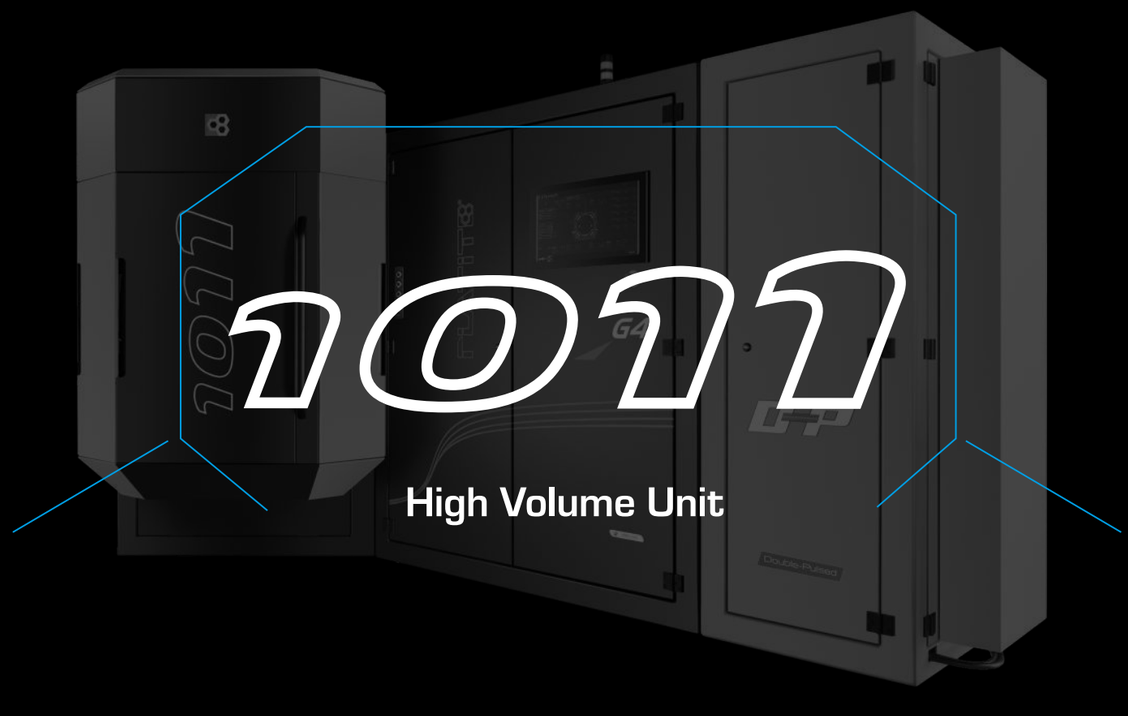
* Average cycle times in an ongoing production with max. number of cathodes in use.

Modular carousel systems:
- 3 or 6 or 9 axes

Software:
- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:
- Footprint: W 3,450 × D 2,250 × H 2,595 [mm]

Standard coating units

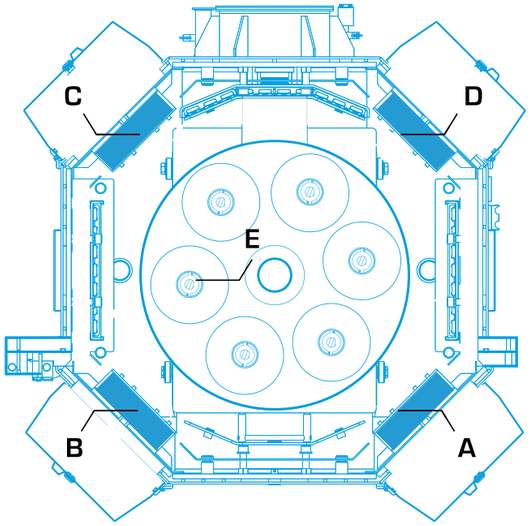


AR

PLATIT® π - Series

1011 G4 High Volume Unit

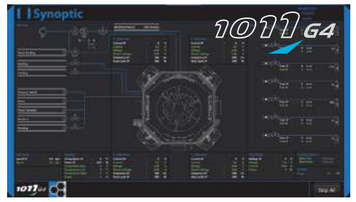
As the backbone of every high-volume coating center, PL1011 G4 combines maximum production availability with a user-friendly interface and an efficient maintenance concept. It's equipped with four Planar cathodes utilizing the latest ARC technology for the deposition of all PLATIT standard coatings in consistently high quality.



A Planar Cathode
B Planar Cathode
C Planar Cathode
D Planar Cathode
E Carousel

Easy Big Power

The PL1011 G4 represents the next generation of a robust PVD coating unit from PLATIT for customers who seek a combination of process reliability and high-quality coatings at a low cost per tool. Its new design speaks for changes and modernization: the simpler construction enables better service; the new technological features such as the Plasma-Nitriding and Double-Pulsed options improve the coating properties and process for various applications.



Technologies applied:
- 4 × Planar cathode using ARC technology for depositing
- Double-Pulsed
- Plasma-Nitriding

PLATIT®

AR

Targets	Signature	Double	Plasma	Cycle	Max. Load	Solution	Service
4	Coatings	Pulsed	Nitriding	≥ 7 h	750 kg	Turnkey	Worldwide

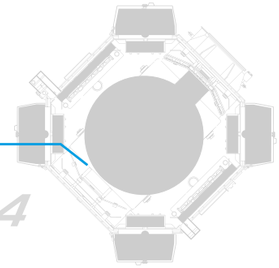
1011 G4 High Volume Unit

Plasma-Nitriding feature

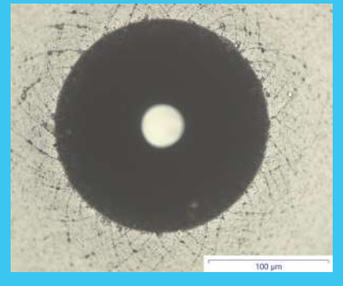
The PL1011 G4 with Plasma-Nitriding features a thermochemical plasma nitriding process integrated in the PVD coating process. After loading, a high vacuum is created, the chamber is heated, then the substrates are nitrided, a proprietary PLATIT etching process is switched on, and only then the suitable PVD coating is deposited.

Plasma nitriding builds a hardness gradient underneath the PVD coating to ensure homogeneous transition from the relatively soft substrate to the very hard PVD layer. This transition is the major challenge in metal forming applications with standard cold forming steels such as 1.2379 / D2.

Highlights:
- Better coating adhesion
- Increased substrate surface hardness
- Improved wear resistance as well as resistance to deformation of the nitrided substrate
- Extending production lifetime of molds and dies, in turn lowering tooling costs



Comparison of AlCrN 1011 G4



AlCrN, deposited on standard substrate

AlCrN, deposited on nitrided substrate

Improved coating adhesion and less plastic deformation due to increased substrate hardness.

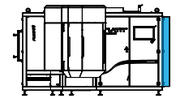
Double-Pulsed feature

PLATIT PL1011 G4 with Double-Pulsed feature is intended for customers with large coating volumes demanding the highest possible throughput.
While faster deposition rates often result in rougher coatings, PL1011 G4 Double-Pulsed does not sacrifice either coating quality or surface finish, keeping all the advantages of ARC processes.

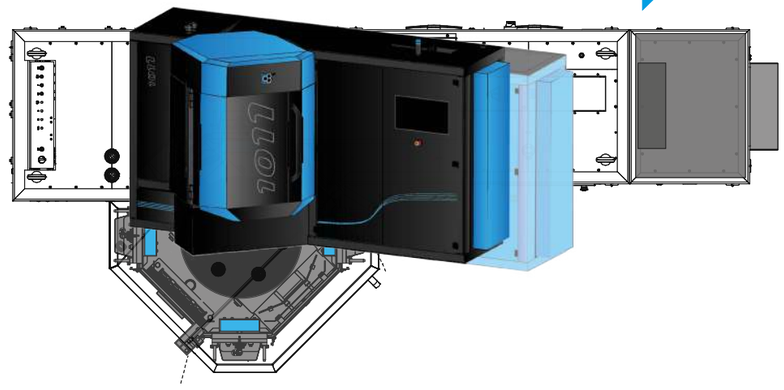
With an extended power supply bank, PL1011 G4 Double-Pulsed allows eight ARC power supplies to run simultaneously in both DC and pulsed modes, with a wider race track on the target leading to an improved target utilization.

Highlights:
- Advanced ARC technology results in high productivity with 30 % faster coating deposition time
- Excellent coating quality and surface finish
- Improved target utilization

1011 G4



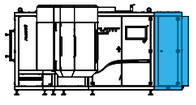
Standard version



Chassis concept - Hardware feature

Version with Double-Pulsed module

Double-Pulsed DP



1011 G4 High Volume Unit

Specifications

Etching technologies applied:
- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:
- Max. coating volume: ø 715 × H 805 [mm]
- Max. coating height with defined coating thickness: 711 mm
- Max. load: 750 kg; higher weight upon request

3–4 batches / day for*:

Shank tools (2 µm):	ø 8 × 70 [mm]	1,008 pcs.	7–8 h
Inserts (3 µm):	ø 12 × 4 [mm]	11,760 pcs.	9–10 h
Hobs (4 µm):	ø 80 × 180 [mm]	36 pcs.	7–8 h
Hobs (4 µm):	ø 80 × 100 [mm]	72 pcs.	7–8 h

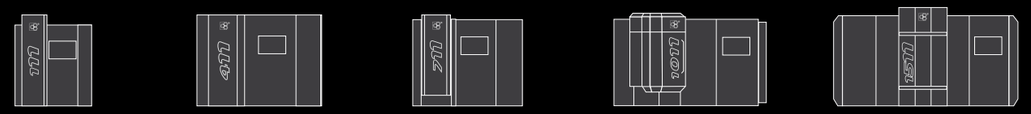
* Durchschnittliche Zykluszeiten in einer laufenden Produktion mit einer maximalen Anzahl von Kathoden im Einsatz.

Modular carousel systems:
- 1 to 12 axes

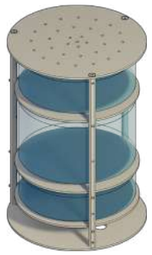
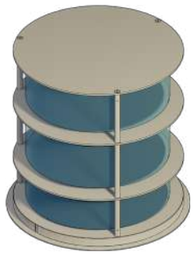
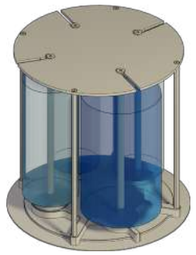
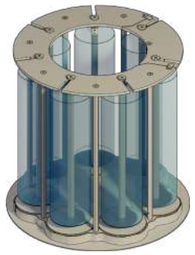
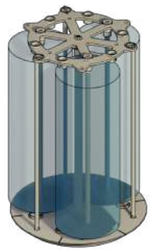
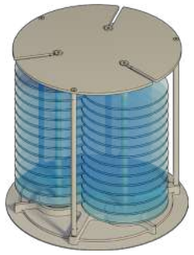
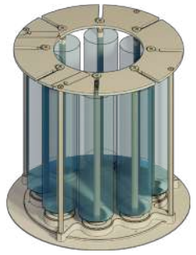
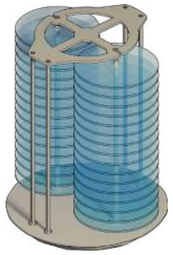
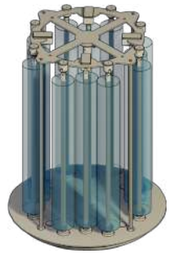
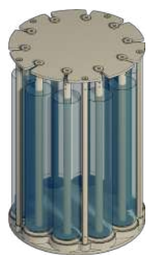
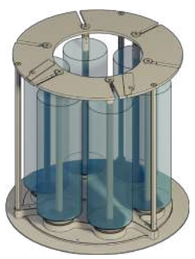
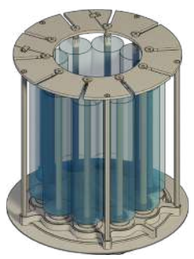
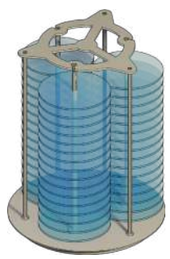
Software:
- PLATIT SmartSoftware (PC and PLC system) with touch screen
- Statistics and help function via user interface
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance
- Newly designed recipe editor

Machine dimensions:
- Footprint: W 4,000 × D 2,250 × H 2,350 [mm]
- Footprint Double-Pulsed option: W 4,700 × D 2,250 × H 2,350 [mm]

11-SERIES ACCESSORIES



Carousels

	111	411				711	1011		Holders
Max. coatable height	498 mm	500 mm				805 mm	805 mm		
									
	Single rotation D ≤ 355 mm	**Single rotation** D ≤ 500 mm for saw blades, D ≤ 460 mm for molds & dies	**4 asymmetric axes** D3 ≤ 183 mm, D1 ≤ 250 mm	**7 axes for triple rotation for gearboxes** D ≤ 143 mm		**3 axes for kicker** D ≤ 270 mm	**Single rotation** D ≤ 700 mm	**4 axes for kicker** D ≤ 270 mm	**Disc with gears**
									
	4 axes for continuous triple rotation for gearboxes D ≤ 143 mm	**3 axes for saw blades with overlap** D ≤ 285 mm	**4 / 8 axes** D4 ≤ 215 mm / D8 ≤ 115 mm	**6 / 12 axes** D6 ≤ 145 mm / D12 ≤ 100 mm		**6 axes for kicker or gearboxes** D ≤ 150 mm	**2 axes for saw blades with overlap** D ≤ 450 mm	**4 / 8 / 12 axes for kicker** D ≤ 170 mm	**Gearbox with triple rotation**
									
	10 axes for continuous double rotation D ≤ 77 mm	**3 / 6 axes** D3 ≤ 220 mm / D6 ≤ 150 mm	**5 / 10 axes** D5 ≤ 175 mm / D10 ≤ 94 mm	**14 axes** D ≤ 85 mm		**9 axes for kicker** D ≤ 95 mm	**3 axes for saw blades** D ≤ 420 mm with overlap, D ≤ 250 mm without overlap	**10 axes for gearboxes** D ≤ 143 mm	**Quad gearbox for quad rotation**

Exemplary illustrations

Loading capacities

Pi111

Tool type	Tool diameter	Tool length	Satellites	Discs / satellite	Holders / disc	Tools / holder	Tools / disc	Tools / batch	Holder type
Shaft Tool	6 mm	50 mm	4	4	5	9	45	720	G
	6 mm	50 mm	4	4	8	4	32	512	D
	6 mm	50 mm	4	4	18	1	18	288	A
	8 mm	60 mm	4	4	18	1	18	288	A
	10 mm	70 mm	4	4	18	1	18	288	A
	20 mm	100 mm	4	3	12	1	12	144	A
Insert	12 mm	4 mm	4	38	18	1	684	2,736	C
Hob	80 mm	100 mm	4	4	1	1	1	16	F
	75 mm	100 mm	10	4	1	1	1	40	F

Pi411

Tool type	Tool diameter	Tool length	Satellites	Discs / satellite	Holders / disc	Tools / holder	Tools / disc	Tools / batch	Holder type
Shaft Tool	6 mm	50 mm	7	4	5	9	45	1,260	G
	6 mm	50 mm	7	4	8	4	32	896	D
	6 mm	50 mm	7	4	18	1	18	504	A
	8 mm	60 mm	7	4	18	1	18	504	A
	10 mm	70 mm	7	4	18	1	18	504	A
	20 mm	100 mm	7	3	12	1	12	252	A
Insert	12 mm	4 mm	7	38	18	1	684	4,788	C
Hob	80 mm	100 mm	7	4	1	1	1	28	F
	80 mm	100 mm	14	4	1	1	1	56	F

PL711

Tool type	Tool diameter	Tool length	Satellites	Discs / satellite	Holders / disc	Tools / holder	Tools / disc	Tools / batch	Holder type
Shaft Tool	6 mm	50 mm	6	5	5	9	45	1,350	G
	6 mm	50 mm	6	6	8	4	32	1,152	D
	6 mm	50 mm	6	6	18	1	18	648	A
	8 mm	60 mm	6	5	18	1	18	540	A
	10 mm	70 mm	6	5	18	1	18	540	A
	20 mm	100 mm	6	4	12	1	12	288	A
Insert	12 mm	4 mm	6	38	18	1	684	4,104	C
Molds & dies	160 mm	130 mm	3	4	1	1	1	12	F
Sliding parts with DLC2	25 × 10 mm	130 mm	3	4	4	1	4	48	F

PL1011

Tool type	Tool diameter	Tool length	Satellites	Discs / satellite	Holders / disc	Tools / holder	Tools / disc	Tools / batch	Holder type
Shaft Tool	6 mm	50 mm	4	7	15	4	60	1,680	E
	6 mm	50 mm	4	7	42	1	42	1,176	B
	8 mm	60 mm	4	7	36	1	36	1,008	B
	10 mm	70 mm	4	6	30	1	30	720	B
	20 mm	100 mm	4	5	23	1	23	460	B
Insert	12 mm	4 mm	4	2 × 35	42	1	1470	11,760	C
Hob	140 mm	100 mm	10	6	1	1	1	60	F
	80 mm	100 mm	12	6	1	1	1	72	F

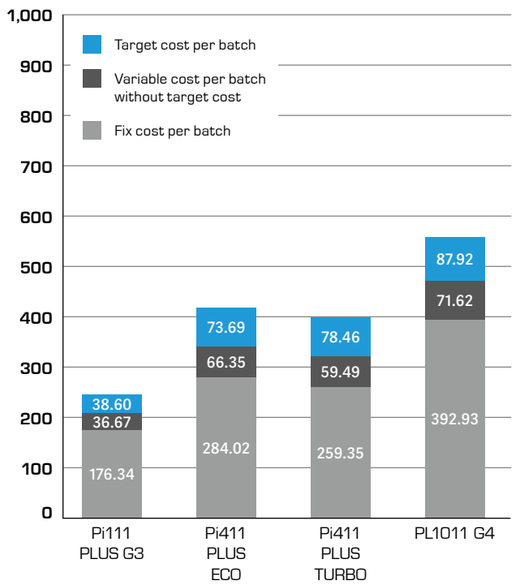
Holder type:
A Tool in a sleeve, driven by a gearbox
B Tool in a sleeve, driven by a kicker
C Insert with a hole, speared on a rod
D Tool in a revolver, driven by a gearbox
E Tool in a revolver, driven by a kicker
F Hob on a satellite / rod
G Tool in a sleeve, driven by a quad gearbox

Process cost comparison

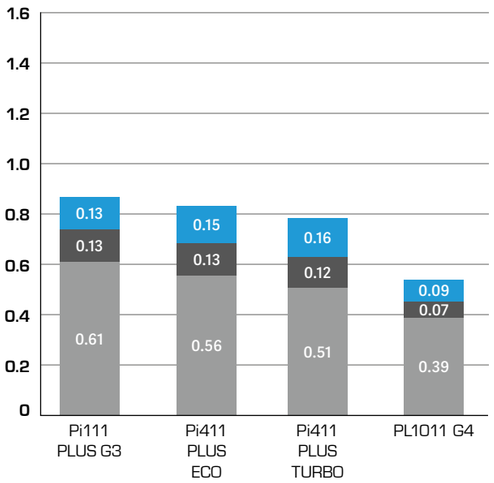
When calculating an investment in a PVD coating turnkey system, there are several variables to be taken into consideration. On this page we give you further insights about how fixed and variable costs add up for different PLATIT coating systems. We are using the case of a German SME coating 10 × 70 mm shank tools with three different coatings – AlTiN, Omnis and TiXCo3.

The diagram on the right visualizes that the majority of the batch costs of a PVD system are determined by the fixed costs. The main cost drivers are depreciation costs for the investment and the personnel costs for the operators. The variable costs, on the other hand, typically amount to less than one sixth of the total operating costs. In particular, the cost of the targets account for only 15–20 % of the total cost per batch.

Cost per batch [CHF]:



Cost per tool [CHF]:

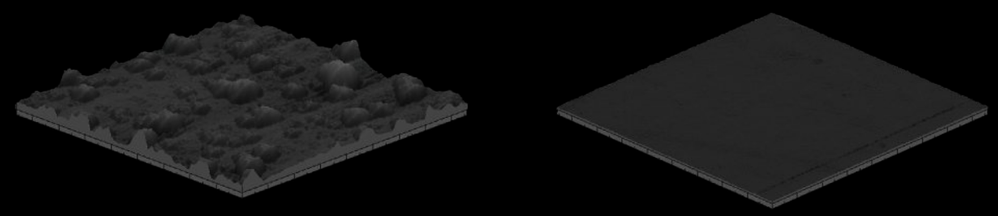


The diagram on the left visualizes the breakdown of cost per tool in different PLATIT coating systems. As it is shown in the diagram, the cost per tools decrease significantly in large-sized PVD coating units due to scale effects.

- Target cost per tool
- Variable cost per tool (without target cost)
- Fixed cost per tool

Detailed case description:
German tool manufacturer, 10 × 70 mm shank tools
Coatings: AlTiN (40 %), Omnis (40 %), TiXCo3 (20 %)
Costs included:
Fixed costs: Investment in PVD system incl. production accessories, depreciation (8 years, 240 working days per year), operator wages, rent and maintenance
Other variable costs: energy and chemicals

COATINGS



PLATIT® π - Series

Coatings

Cathode configurations

		111 2 × LARC® PLUS, TiCN option available		411 3 × LARC®, additional options available			711 2 × Planar HiPIMS & PECVD mode	1011 4 × Planar ARC, additional options available
	Coatings	Option	Cathodes	Option	Cathodes		Cathodes	Cathodes
1	TiN	Standard	-, Ti	ECO	Ti, -, -		Ti, Ti	Ti, -, Ti, -
				SCIL	LGD, -, -, Ti SCIL			
2	TiCN	TiCN	-, Ti	ECO	Ti, -, -			Ti, -, Ti, -
3	TiAlN	Standard	Al, Ti	ECO	Ti, Al, -			Ti, AlTi40, TiAl50, AlTi40
				TURBO	Ti, Al, -, AlTi33			
4	TiAlCN			ECO	Ti, Al, -			Ti, TiAl25, Ti, TiAl25
5	AlTiN	Standard	Al, Ti	ECO	Ti, Al, -			Ti, AlTi40, AlTi33, AlTi40
				TURBO	Ti, Al, -, AlTi33			
6	CrN	Standard	-, Cr	ECO	Cr, -, -		Cr, Cr	Cr, -, Cr, -
7	CrTiN	Standard	Cr, Ti	ECO	Ti, -, Cr			Ti, Cr, Ti, Cr
8	TapCT			SCIL	LGD, -, -, CrTi50 SCIL			
9	ZrN	Standard	Zr, Ti	ECO	Ti, -, Zr			Ti, Zr, Ti, Zr
10	AlCrN			LACS	-, -, Cr, AlCr30 SCIL			
11	Omnis	Standard	Al, Cr	ECO	Al, AlCr30, Cr			-, AlCr36, AlCr36, AlCr36
				ECO	AlCr35, AlCr35, AlCr35			
12	AlTiCrN	Standard	AlCr30, Ti	ECO	Ti, Al, Cr			Cr, AlTi40, AlCr36, AlTi40
13	nACo	Standard	AlSi12, Ti	ECO	Ti, AlSi18, -			TiSi20, AlTi40, TiSi25, AlTi40
				TURBO	Ti, AlSi18, -, AlTi33			
14	nACRo	Standard	AlSi12, Cr	ECO	-, AlSi18, Cr			
				TURBO	-, AlSi18, Cr, AlTi33			
15	TiXCo3	Standard	AlTi33, TiSi20	ECO	Ti, Al, TiSi20			TiSi20, AlTi40, TiSi25, AlTi40
				TURBO	Ti, Al, TiSi20, AlTi33			
16	TiXCo4			TURBO	Ti, Al, TiSi20, AlCr30			
17	PSiX			ECO	Ti, Al, TiSi20			TiSi20, AlTi40, TiSi25, AlTi40
18	BorAC			ECO	Al, AlCrB20-10, Cr			-, AlCr36, AlCrB20-10, AlCr36
				ECO	AlCr35, AlCrB20-10, AlCr35			
19	TiBor			LACS	Ti, -, -, TiB2 SCIL			
20	DLC1: TiCN + a-C:H:Me	TiCN	-, Ti	ECO	Ti, -, -			Ti, -, Ti, -
21	DLC2: TiN + a-C:H:Si			SCIL & DLC	LGD, -, -, Ti SCIL			
22	DLC2: CrN + a-C:H(:Si)			DLC	-, -, Cr		Cr, Cr	-, Cr, -, Cr
23	DLC3: Cr + ta-C / a-C			LACS	-, -, Cr, C SCIL			
24	nACoX			TURBO & OXI	Ti, AlSi18, AlCr45, AlTi33			

Further coatings and cathode configurations on request

Coatings

Coatings for cutting tools

			Turning	Milling			Gear cutting					Sawing		Drilling		Deep hole drilling	Reaming	Broaching	Tapping	
WORKPIECE MATERIAL			**Inserts**	**Inserts**	**Shank tools**	**Micro tools**	**Hobs**	**Pinion cutting**	**Skiving**	**Fly cutters, stick blades**		**Saw blades**	**Band saws**	**Drilling**	**Micro tools**				**Taps, thread cutters**	**Tap forming, thread forming**
Steels	Dry	A	nACo	Omnis	Omnis	AlCrN	Omnis	Omnis	Omnis	TiXCo4		AlTiCrN	nACo	AlTiN	AlTiN	AlTiN	nACo	TiN	TiN	TapCT
		B	AlTiN	BorAC	BorAC	-	BorAC	BorAC	BorAC	AlTiCrN		AlTiN	TiAlCN	PSiX	TiXCo3	TiXCo3	TiXCo3	TiCN	TiCN	TiCN
	Wet	A	nACo	AlTiCrN	AlTiCrN	AlCrN	Omnis	Omnis	Omnis	TiXCo4		AlTiCrN	nACo	AlTiN	AlTiN	AlTiN	nACo	TiN	TiN	TapCT
		B	AlTiN	Omnis	Omnis	-	AlTiCrN	AlTiCrN	BorAC	AlTiCrN		AlTiN	TiAlCN	PSiX	TiXCo3	TiXCo3	TiXCo3	TiCN	TiCN	TiCN
Steels hardened < 55 HRC	Dry / Wet	A	TiXCo4	TiXCo4	TiXCo4	TiXCo3	-	-	TiXCo4	-		nACo	nACo	PSiX	TiXCo3	-	nACo	-	-	-
		B	nACo	nACo	nACo	-	-	-	BorAC	-		AlTiN	AlTiN	nACo	nACo	-	TiXCo3	-	-	-
Steels hardened > 55 HRC	Dry	A	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	-	TiXCo4	-		-	-	TiXCo3	TiXCo3	-	-	-	-	-
		B	PSiX	PSiX	PSiX	-	-	-	PSiX	-		-	-	PSiX	-	-	-	-	-	-
	Wet	A	PSiX	PSiX	PSiX	TiXCo3	-	-	TiXCo4	-		-	-	-	-	-	-	-	-	-
		B	nACo	nACo	nACo	-	-	-	PSiX	-		-	-	-	-	-	-	-	-	-
Stainless steel < 45 HRC	Dry	A	nACo	nACo	nACo	nACo	-	-	-	-		AlTiN	nACo	AlTiN	AlTiN	AlTiN	nACo	-	TiN	TapCT
		B	AlTiN	AlTiN	AlTiN	-	-	-	-	-		TiAlCN	TiAlCN	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	TiCN	TiCN
	Wet	A	PSiX	PSiX	PSiX	nACo	-	-	-	-		AlTiN	nACo	AlTiN	AlTiN	AlTiN	nACo	-	TiN	TapCT
		B	AlTiN	AlTiN	AlTiN	-	-	-	-	-		TiAlCN	TiAlCN	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	TiCN	TiCN
Stainless steel > 45 HRC	Dry	A	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	-	-	-		-	-	AlTiN	AlTiN	AlTiN	nACo	-	TiN	-
		B	nACo	PSiX	PSiX	-	-	-	-	-		-	-	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	TiCN	-
	Wet	A	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	-	-	-		-	-	AlTiN	AlTiN	AlTiN	nACo	-	TiN	-
		B	TiAlCN	PSiX	PSiX	-	-	-	-	-		-	-	TiXCo3	TiXCo3	TiXCo3	TiXCo3	-	TiCN	-
Superalloys Ni-based	Dry / Wet	A	nACoX	nACoX	PSiX	TiXCo3	-	-	-	-		AlTiCrN	AlTiCrN	TiXCo4	-	-	-	-	TiCN	-
		B	AlTiN	PSiX	TiXCo4	-	-	-	-	-		AlTiN	AlTiN	nACoX	-	-	-	-	TiAlCN	-
Superalloys Ti-based	Dry / Wet	A	nACo	nACo	nACo	nACo	-	-	-	-		AlTiCrN	AlTiCrN	TiXCo3	-	-	TiBor	-	TiCN	-
		B	TiBor	TiBor	TiBor	TiBor	-	-	-	-		AlTiN	AlTiN	AlTiN	-	-	PSiX	-	TiAlCN	-
Cast iron	Dry / Wet	A	nACo	nACo	nACo	nACo	-	-	-	-		-	-	TiXCo3	-	TiN	TiXCo3	-	TiCN	-
		B	AlTiN	AlTiN	AlTiN		-	-	-	-		-	-	nACo	-	TiCN	nACo	-	TiAlCN	-
Aluminium Si > 12 %	Dry / Wet	A	nACRo	nACRo	nACRo	nACRo	-	-	-	-		nACRo	nACRo	nACRo	nACRo	-	TiBor	-	TiCN	-
		B	TiBor	TiBor	TiBor	TiBor	-	-	-	-		AlTiCrN	AlTiCrN	TiBor	TiBor	-	PSiX	-	TiAlCN	-
Aluminium Si < 12 %	Dry / Wet	A	DLC3	DLC3	DLC3	DLC3	-	-	-	-		DLC3	ZrN	TiBor	TiBor	-	TiBor	-	TiCN	TiN
		B	TiBor	TiBor	TiBor	TiBor	-	-	-	-		ZrN	-	ZrN	ZrN	-	DLC3	-	TiBor	ZrN
Copper, bronze, brass	Dry / Wet	A	CrN	CrN	CrN	CrN	-	-	-	-		CrN	CrN	TiAlCN	-	-	TiXCo3	-	TiCN	TiN
		B	DLC2	DLC2	DLC2	DLC2	-	-	-	-		-	-	CrN	-	-	nACo	-	TiAlCN	ZrN
Plastic	Dry / Wet	A	-	-	DLC3	-	-	-	-	-		-	-	TiXCo3	-	-	-	-	-	-
		B	-	-	TiBor	-	-	-	-	-		-	-	DLC2	-	-	-	-	-	-
Graphite	Dry	A	DLC3	DLC3	DLC3	DLC3	-	-	-	-		-	-	DLC3	DLC3	-	-	-	-	-
		B	-	-	-	-	-	-	-	-		-	-	TiXCo4	TiXCo4	-	-	-	-	-
	Wet	A	TiXCo4	TiXCo4	TiXCo4	TiXCo3	-	-	-	-		-	-	TiXCo4	TiXCo4	-	-	-	-	-
		B	DLC3	DLC3	DLC3	DLC3	-	-	-	-		-	-	DLC3	DLC3	-	-	-	-	-
Carbon fiber reinforced polymer	Dry / Wet	A	-	-	DLC3	DLC3	-	-	-	-		DLC3	-	DLC3	DLC3	-	-	-	-	-
		B	-	-	TiXCo4	TiXCo3	-	-	-	-		-	-	TiXCo3	TiXCo3	-	-	-	-	-
Wood	Dry / Wet	A	-	DLC2	DLC2	-	-	-	-	-		DLC2	-	DLC2	-	-	-	-	-	-
		B	-	CrN	CrN	-	-	-	-	-		CrN	-	TiXCo3	-	-	-	-	-	-

A primary recommendation **B** secondary recommendation

Coatings for chipless forming

TOOL MATERIAL		Fine-blanking	Punching	Injection molding Plastic	Injection molding Aluminum	Forming, embossing	Deep drawing	Extrusion
HSS	A	FeinAl Plus*	FeinAl Plus*	-	-	CrN	FeinAl*	nACRo
	B	FeinAl*	FeinAl*	-	-	TiBor	FeinAl Plus*	FeinAl*
Carbide	A	FeinAl Plus*	FeinAl Plus*	-	-	-	-	-
	B	FeinAl*	FeinAl*	-	-	-	-	-
Steels unalloyed	A	-	-	CrN	AlTiCrN	-	-	-
	B	-	-	TiN	nACRo	-	-	-
Steels harde-ned	A	FeinAl Plus*	FeinAl Plus*	CrN	AlTiCrN	CrN	FeinAl*	nACRo
	B	FeinAl*	FeinAl*	TiN	nACRo	TiBor	FeinAl Plus*	FeinAl*
Aluminum Si > 12%	A	-	-	CrN	-	CrN	-	-
	B	-	-	TiN	-	TiBor	-	-
Aluminum Si < 12%	A	-	-	-	-	CrN	-	-
	B	-	-	-	-	TiBor	-	-
Copper, bronze, brass	A	-	-	-	-	CrN	-	-
	B	-	-	-	-	TiBor	-	-

A primary recommendation
B secondary recommendation

* Trademark owned by Feintool Group

Coatings for components

WORKPIECE MATERIAL		Machine parts[1]	Medical components[2] Medical implants	Medical components[2] Surgical, dental instruments	Medical components[2] Anti-bacterial medical components	Tribology	Decorative materials
Steels unalloyed < 1000 N / mm²	A	-	-	-	-	DLC2	-
	B	-	-	-	-	DLC3	-
Steels unalloyed > 1000 N / mm²	A	-	-	-	-	DLC2	-
	B	-	-	-	-	DLC3	-
Steels hardened < 55 HRC	A	CrTiN	-	-	-	DLC2	-
	B	-	-	-	-	DLC3	-
Steels hardened > 55 HRC	A	CrTiN	-	-	-	DLC2	-
	B	-	-	-	-	DLC3	-
Stainless steel	A	-	-	DLC2	TiN-AB	DLC2	Custom
	B	-	-	DLC3	DLC-AB	DLC3	-
Stainless steel > 45 HRC	A	-	-	-	-	DLC2	Custom
	B	-	-	-	-	DLC3	-
Superalloys Ni-based	A	-	-	-	-	DLC2	-
Superalloys Ti-based	A	-	Ti2N	DLC3	-	DLC2	-
	B	-	ZrN	DLC2	-	-	-
Cast iron	A	CrN	-	-	-	-	-
Aluminum Si < 12%	A	CrN	-	-	-	-	-
Copper	A	-	-	-	TiN-AB	-	Custom
	B	-	-	-	DLC-AB	-	-
Bronze, brass	A	-	-	-	TiN-AB	-	Custom
	B	-	-	-	DLC-AB	-	-

A primary recommendation
B secondary recommendation

[1] in abrasive and corrosive environment such as gears, water pumps, tool holders
[2] following PLATIT coatings are tested for biocompatibility and certified accordingly: AlTiN, CrN, DLC, TiCN, TiN, ZrN

Coating properties

		Color	Nano-hardness [GPa] by Fisher Nanoindentor	Coating thickness [µm]	Coefficient of friction [µ] PoD (at RT, 50 % humidity)	Max. service temperature [°C]
1	**TiN**	Gold	24–26	1–10	0.4	600
2	**TiCN**	Grey	36–38	1–3	0.25	450
3	**TiAlN**	Violet grey	36–38	1–5	0.5	700
4	**TiAlCN**	Red violet	34–36	1–5	0.25	450
5	**AlTiN**	Blue grey	36–38	1–5	0.6	900
6	**CrN**	Silver	21–23	1–10	0.5	700
7	**CrTiN**	Satin silver	28–30	1–10	0.4	700
8	**TapCT**	Silver	28–30	1–5	0.4	700
9	**ZrN**	White gold	21–23	1–5	0.4	550
10	**AlCrN**	Grey	36–38	1–5	0.6	900
11	**Omnis**	Grey / Anthracite	33–35	0.3–6.0	0.5	1,100
12	**AlTiCrN**	Grey	36–38	1–5	0.5	900
13	**nACo**	Blue violet	39–41	1–4	0.5	1,200
14	**nACRo**	Grey	39–41	1–4	0.5	1,100
15	**TiXCo3**	Copper	42–44	1–4	0.4	1,100
16	**TiXCo4**	Grey	42–44	1–4	0.4	1,100
17	**PSiX**	Red brown	42–44	1–4	0.4	1,100
18	**BorAC**	Grey	38–40	1–5	0.5	900
19	**TiBor**	Satin silver	45	1–5	0.4	600
20	**DLC1: TiCN + a-C:H:Me**	Anthracite	36 / 20	1–3	0.1–0.2	400
21	**DLC2: TiN + a-C:H:Si**	Anthracite	> 25	1–3	0.1–0.2	400
22	**DLC2: CrN + a-C:H(:Si)**	Anthracite	> 25	1–3	0.1–0.2	400
23	**DLC3: Cr + ta-C / a-C in Pi411**	From rainbow colors to anthracite	45–50	0.3–1	0.1	450
24	**nACoX**	Dark grey	30–32	4–10	0.5	1,200

The given physical values may vary for different coating structures (mono-, gradient-, multi- and nanolayers).

If a coating can be deposited with ARC, SPUTTER and LACS® option, the properties of the ARC option are given.

Signature and Dedicated Coatings

PLATIT's Signature Coatings are exclusively developed by our R&D teams using the unique features of the PLATIT technology. They combine years of experience and know-how in the field of coating development with the latest technical innovations.

Our Signature Coatings promise the highest performance for their dedicated applications in the field of cutting, forming and tribological components. PLATIT customers can differentiate themselves from competitors and stand out from the market standard with the deposition of Signature Coatings.

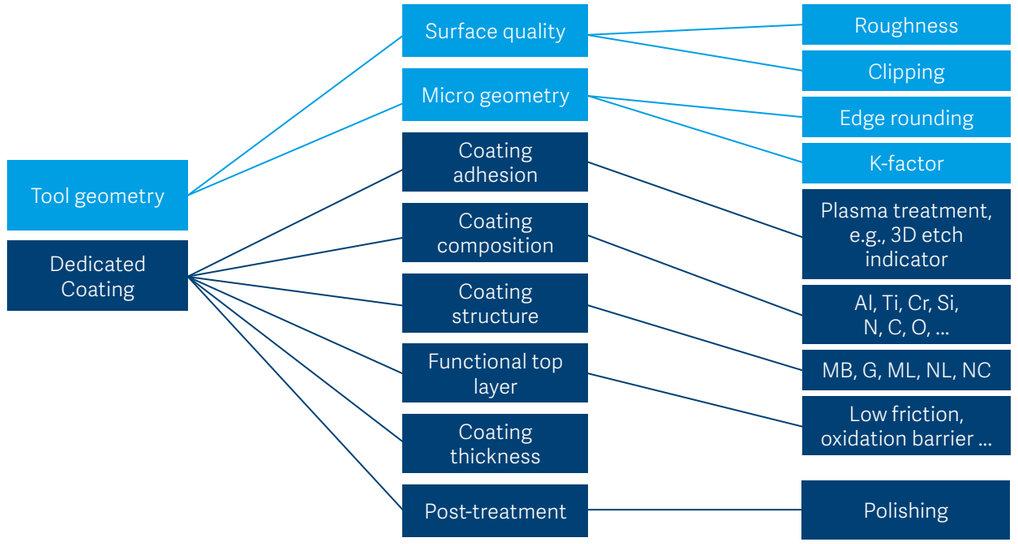
Dedicated Coatings

Dedicated Coatings from PLATIT are tailored to individual needs of specific application and developed together with the customer for the customer. True to the open-source approach of PLATIT, the processes and recipes are open to engineers to enable innovations to accelerate.

Our Dedicated Coatings allow a variety of process parameters, configurations of the cathodes, their positions, deposition technology as well as pre- and post-treatments, depending on the adaption needs. These coatings are not limited to a certain application, going further from the field of cutting, forming and tribological components towards further industries and requirements.

Development of new Dedicated Coatings

PLATIT's R&D team inspects the geometry of the tool and considers different parameters for the development of Dedicated Coatings.



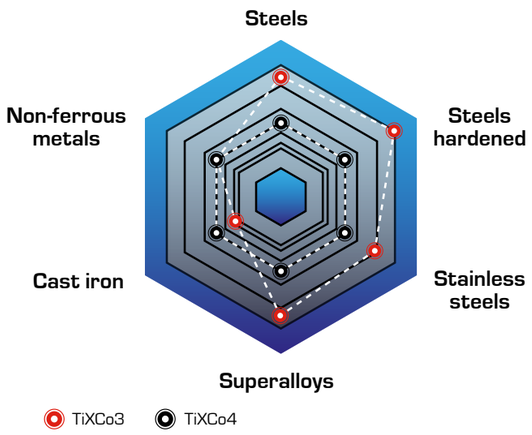
Signature Coating TiXCo

TiXCo3 and TiXCo4

As our hardest nanocomposite, TiXCo3 is especially suitable for hard machining. It can be used at very high temperatures and is therefore suitable for finishing processes in milling, drilling and reaming. TiXCo4 is used for broadband applications.

Highlights:
- TiXCo3:
  - High surface quality
  - Extremely hard and very wear-resistant
  - For super-hard machining
- TiXCo4:
  - Wide range of application and use

Characteristics in cutting:

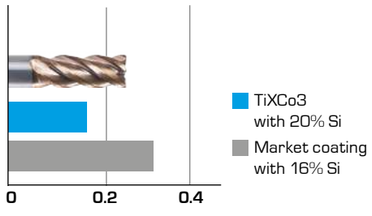


Specifications

Color	copper with TiXCo3 grey with TiXCo4
Nano-hardness [GPa]	42–44
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.4
Coating thickness [µm]	1–4
Max. service temperature [°C]	1,100
Coating temperature [°C]	450–500
111 PLUS G3	TiXCo3 (AlTi33, TiSi20)
411 PLUS ECO	TiXCo3 (Ti, Al, TiSi20)
411 PLUS TURBO	TiXCo3 (Ti, Al, TiSi20, AlTi33) TiXCo4 (Ti, Al, TiSi20, AlCr30)
1011 G4	TiXCo3 (TiSi20, AlTi40, TiSi25, AlTi40)

Milling in X210Cr13 with solid carbide end mill D6:

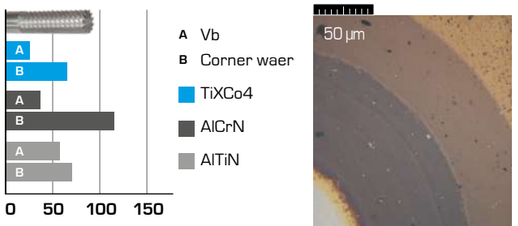
Wear Vb [µm]



Tool: solid carbide end mill; D6
Workpiece material: X210Cr13; 1.2080; 64 HRC
Cooling: dry air, 5 bar; ap = 0.09 mm; ae = 0.06 mm;
n = 16 820 rpm; f = 0.1 mm / rot
Source: South Korean tool manufacturer

Milling in SKD61 with solid carbide end mill D8:

Wear Vb [µm] after 27 m cutting length



Tool: solid carbide end mill; D8;
cutting length = 27 m
Workpiece material: SKD61; 54 HRC
Cooling with emulsion; ap = 4 mm;
ae = 0.03 mm; vc= 100 m / min
Source: Chinese tool manufacturer

Calo 3 layers

TiXCo3: TiN → AlTi(Si)N → TiSiN
TiXCo4: TiN → AlCrTi(Si)N → TiSiN

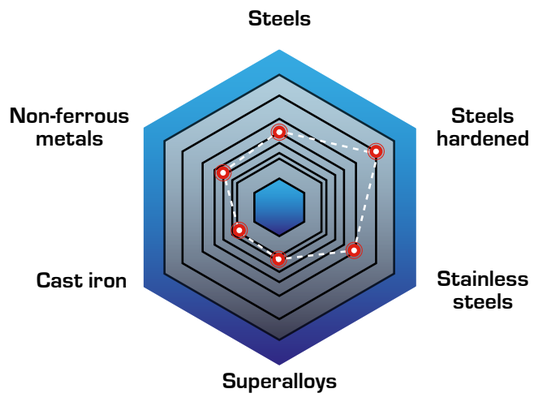
Signature Coating PSiX

Universal hard machining coating

PSiX is a new PLATIT nanocomposite coating with a super-hard top layer. PSiX is based on TiXCo3 but has a silicon-free AlTiN base. Therefore, the aluminum content of PSiX is higher, which increases the coating's thermal stability. The coating is temperature optimized and therefore excellent for hard machining processes like finishing and roughing.

Highlights:
- Thermal stability
- Optimized service temperature
- Low coating residual stress

Charakteristics in cutting:

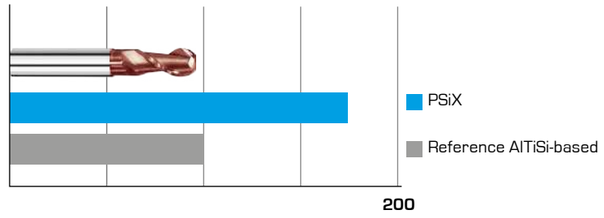


Specifications

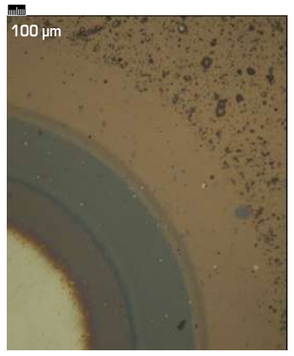
Color	red brown
Nano-hardness [GPa]	42–44
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.4
Coating thickness [µm]	1–4
Max. service temperature [°C]	1,100
Coating temperature [°C]	450–500
411 PLUS ECO	(Ti, Al, TiSi20)
1011 G4	(TiSi20, AlTi40, TiSi25, AlTi40)

Ball nose end mill in 61 HRC:

Lifetime in % at VBmax = 200 m



Tool: ball nose end mill; D10
Workpiece material: 1.2379; 61 HRC
ap = 0.2 mm; ae = 0.5 mm; vc = 182 m / min; fz = 0.14 mm
Source: GFE, Germany



Calo 3 layers

Optional TiN adhesion layer →
AlTiN for reducing coating
residual stress →
AlTiN for high hardness →
TiSiN nanocomposite top layer

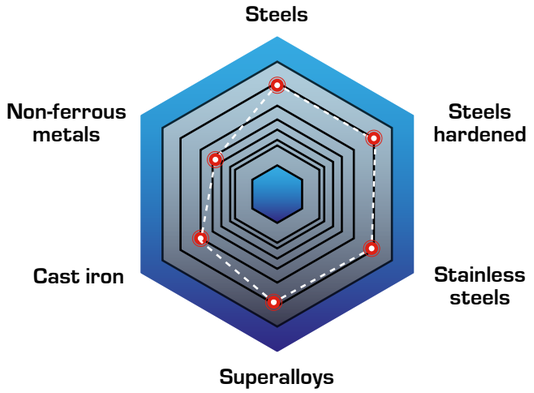
Signature Coating nACo

Universal nanocomposite for milling and drilling C-steels

nACo is one of PLATIT's best-known coating brands. It has proven itself on the market for over 20 years. nACo is an AlTiSi-based nanocomposite coating and performs best in the field of milling and drilling C-steels. The use of nACo provides excellent adhesion and good performance even for more unusual applications such as milling with coated ceramic tools and CBN tools.

Highlights:
- Nanocomposite with Si content
- High temperature stability
- Good hardness
- Reduces adhesion between cuttingedges and work-piece
- Versatile application possibilities

Characteristics in cutting:

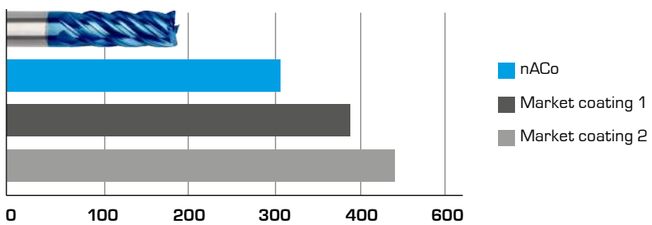


Specifications

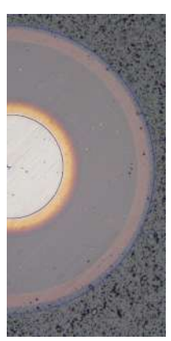
Color	blue violet
Nano-hardness [GPa]	39–41
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.4
Coating thickness [µm]	1–4
Max. service temperature [°C]	1,200
Coating temperature [°C]	400–500
111 PLUS G3	(AlSi12, Ti)
411 PLUS ECO	(Ti, AlSi18, -)
411 PLUS TURBO	(Ti, AlSi18, -, AlTi33)
1011 G4	(TiSi20, AlTi40, TiSi25, AlTi40)

Milling in SUS316 with solid carbide end mill D4:

Wear Vb [µm] after 480 milling operations



Werkzeug: Vollhartmetall-Schaftfräser; D4; z = 4; Schnittlänge = 6 mm
Werkstückmaterial: SUS316
Kühlmittel; ap = 0,1 mm; ae = 4 mm; vc = 100 m / min; n = 8000 U / min; fz = 0,0625 mm / z;
f = 0,2500 mm / U; vf = 2000 mm / min
Quelle: Werkzeughersteller



Calo 3 layers

AlTi(Si)N is deposited on a TiN adhesion layer

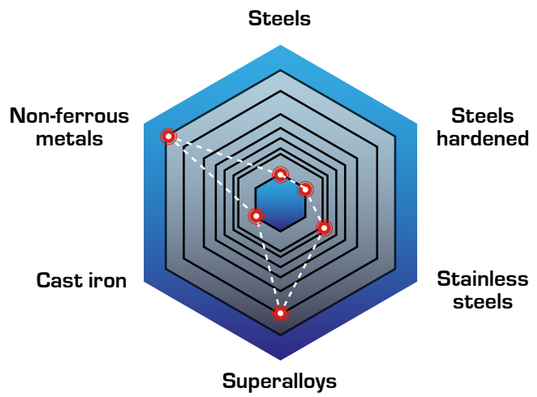
Signature Coating nACRo

Nanocomposite for non-ferrous materials

nACRo is PLATIT`s nanocrystalline nanocomposite. Based on CrN adhesion layer, it has a AlTiCrN microcrystalline core layer for toughness and a AlCrSiN top layer which guarantees thermal stability and wear resistance. Also, nACRo can also be deposited on sharp cutting edges for machining wood, aluminum alloy with Si content > 12% and titanium alloys such as TiAl6V4. Furthermore, nACRo can be used for aluminum injection molding.

Highlights:
- High resistance against temperature changes, oxidation and abrasive wear
- Specialist for machining abrasive aluminum alloys
- Usage also in chipless forming

Charakteristics in cutting:

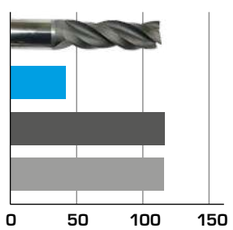


Specifications

Color	grey
Nano-hardness [GPa]	39–41
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.5
Coating thickness [µm]	1–4
Max. service temperature [°C]	1,100
Coating temperature [°C]	450–500
111 PLUS G3	(AlSi12, Cr)
411 PLUS ECO	(-, AlSi18, Cr)
411 PLUS TURBO	(-, AlSi18, Cr, AlTi33)

Milling in abrasive aluminum alloy:

Flank wear [µm]



Tool: solid carbide endmill; D8; z=3; cutting length = 25 mm
Workpiece material: EN AC 4700= <3.2583> AlSi12Cu
Coolant: emulsion
vc = 250 mm/min; n = rpm; ap = 5 mm; ae= 1 mm; fz = 0.16 mm/z
Source: GFE Schmalkalden

Calo 3 layers

CrN adhesion layer →
AlTiCrN core layer →
AlCrSiN top layer

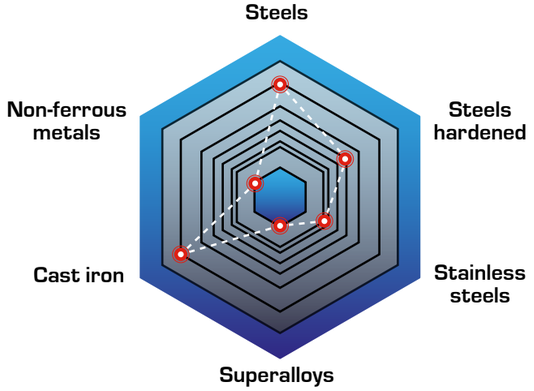
Signature Coating Omnis

Universal high-performance AlCrN-MB coating

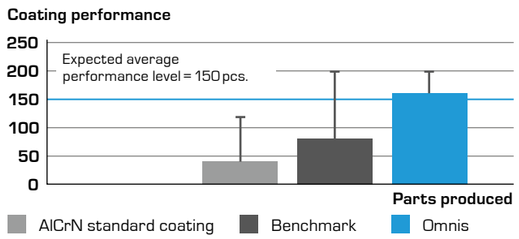
Omnis is a universal high-quality coating developed for a wide range of applications for wet and dry machining:

- Optimized coating properties (hardness, modulus, morphology) with advanced plasma parameters
- Higher productivity and deposition rate through increased process performance
- Advanced BIAS strategy for optimized residual stress distribution
- Use of multi-alloyed targets for maximum productivity

Charakteristics in cutting:



With Omnis from PLATIT, variance between the tests is reduced:



Tool: Shaper cutter; Coating thickness: 3.5 µm
Workpiece material: 1.7131; 33 HRC
Wet machining
Source: Customer in Germany

Highlights:

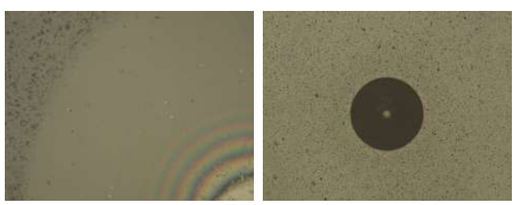
- Universal applicability e. g., for roughing, skiving, hobbing, finishing, forming, micro tools
- Omnis also works in applications typically covered by AlTiN and AlCrSiN coatings
- Superior and predictable wear behavior
- Fast and economical with extremely short batch times, e. g., for 2.0 µm on endmill (3-fold rotation):
  - 4 h with Pi111 PLUS G3
  - 4–5 h with Pi411 PLUS ECO
  - 6–7 h with PL1011 G4

  or 4.0 µm on hob (2-fold rotation):
  - 5–6 h with Pi111 PLUS G3
  - 5–7 h with Pi411 PLUS ECO
  - 7–8 h with PL1011 G4

  Average cycle times in an ongoing production with max. number of cathodes in use.

Specifications

Color	grey / anthracite
Nano-hardness [GPa]	33–35
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.5
Coating thickness [µm]	0.3–6.0
Max. service temperature [°C]	1,100
Coating temperature [°C]	480
111 PLUS G3	(Al, Cr)
Pi411 PLUS ECO	(Al, AlCr30, Cr)
Pi411 PLUS ECO	(AlCr35, AlCr35, AlCr35)
1011 G4	(-, AlCr36, AlCr36, AlCr36)



Omnis

Signature Coating BorAC

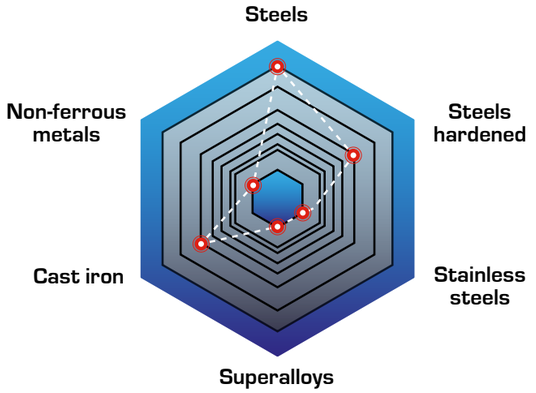
Specialist for highly demanding machining

BorAC consists of a boron-doped AlCrN protective coating, which is especially suitable for crack inhibition and thus for high-speed applications such as transmission and gear cutting tools. BorAC delivers top performance under high loads, especially in gear hobbing and roughing (dry and wet). The coating can be deposited with PLATIT Pi411 PLUS ECO or Pi411 PLUS LACS® - with simultaneous ARC and SPUTTER processes.

Highlights:

- Low coating residual stress
- Crack-resistant
- Minimizes crater wear
- Increases hardness and toughness

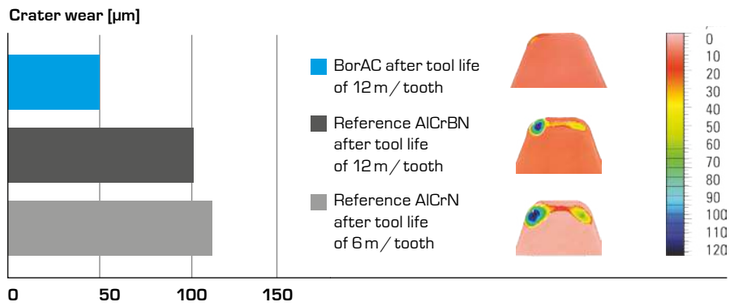
Charakteristics in cutting:



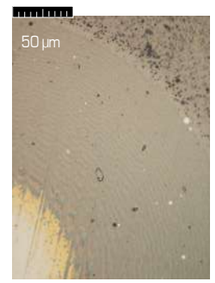
Specifications

Color	grey
Nano-hardness [GPa]	38–40
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.5
Coating thickness [µm]	1–5
Max. service temperature [°C]	900
Coating temperature [°C]	400–500
411 PLUS ECO	(Al, AlCrB20-10, Cr)
411 PLUS ECO	(AlCr35, AlCrB20-10, AlCr35)
1011 G4	(-, AlCr36, AlCrB20-10, AlCr36)

Effect of boron doping on crater wear in hobs:



Tool: HSS hob; D100
Workpiece material: 20 MnCr 5
Cooling air; mn = 4 mm; vc = 220 m / min, fa = -6.4 mm / rot
Max. chip thickness hcu = 0.24 mm
Source: IFG Magdeburg



Calo 3 layers

CrN adhesion layer →
AlCrN →
AlCrBN

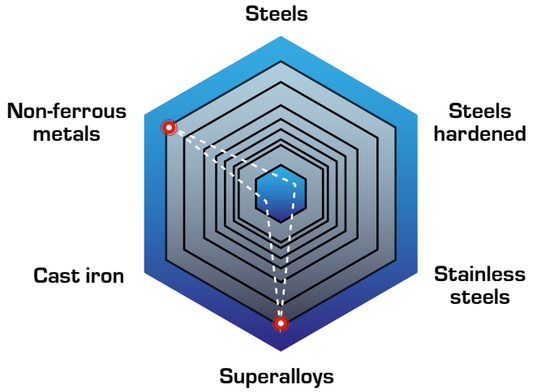
Signature Coating TiBor

LACS® coating for aluminum & titanium alloy machining

TiBor is one of the most efficient PLATIT LACS® coatings. The patented hybrid process of LARC® and central SPUTTERING SCIL® achieves a droplet-free surface which avoids built-up edges. Thus, the cutting edge will be sharp. TiBor performs very well in milling, drilling and reaming of aluminum, titanium and other non-ferrous metals like copper or brass.

Highlights:
- Use for applications which favor build-up edge like Ti6Al4V (grade 5 / TC4) or aluminum
- Highly accurate coating for precise machining
- Increased wear-resistance

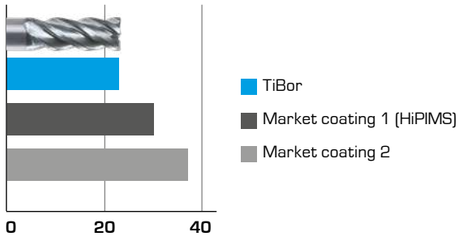
Characteristics in cutting:



Specifications	
Color	satin silver
Nano-hardness [GPa]	45
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.4
Coating thickness [µm]	1–5
Max. service temperature [°C]	600
Coating temperature [°C]	200–400
411 PLUS LACS®	(Ti, -, -, TiB2 SCIL)

Rough milling in Ti6Al4V (TC4):

Wear Vb [µm] after 10 h



Tool: end mill
Workpiece material: Ti6Al4V (TC4)
Spindle speed: 6500 rpm
Cutting speed vc: 1800 mm / min ap= 0.2 mm; ae=3.6 mm
Source: Chinese tool manufacturer

TiBor

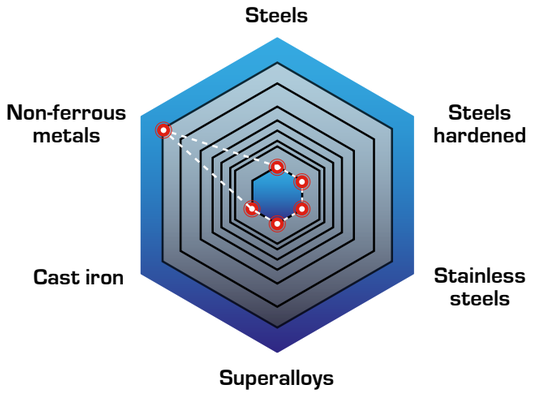
Signature Coating ta-C

Solution for graphite machining and for non-ferrous metals

ta-C belongs to the PLATIT DLC3 hydrogen-free coating generation with over 50 % sp3 content. The high sp3 bond fraction results in a higher density, hardness (at ambient and elevated temperature), thermal stability, oxidation resistance, residual stress and lower thermal conductivity.

Highlights:
- Over 50 % sp3 content
- High density and hardness
- Thermal stability
- Oxidation resistance
- Low chemical affinity
- Low thermal conductivity
- Low roughness
- Stable process and low maintenance intervals

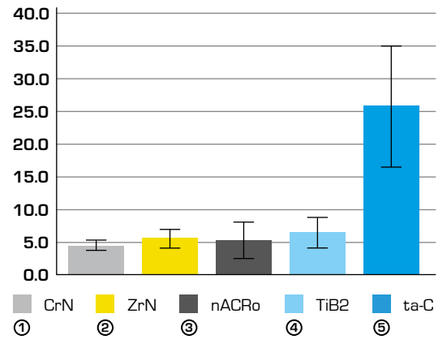
Charakteristics in cutting:



Specifications	
Color	From rainbow colors to anthracite
Nano-hardness [GPa]	35–55
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.1
Coating thickness [µm]	0.3–1
Max. service temperature [°C]	450
Coating temperature [°C]	< 100
411 PLUS LACS®	(-, -, Cr, C SCIL)

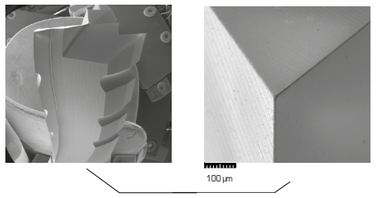
Machining Al alloys with Si content to 10–14 %:
ta-C with Pi411 PLUS LACS® features higher performance and the least torque value measured

Complex Performace CP



Tool: aluminum step drill; GIW/PCG
Workpiece material:
GD-AlSi9Cu3(Fe): 9.3 % Si
Source: PLATIT AG and PannonPLATIT, Budapest, HU

DLC3 coated end mill under scanning electron microscope:



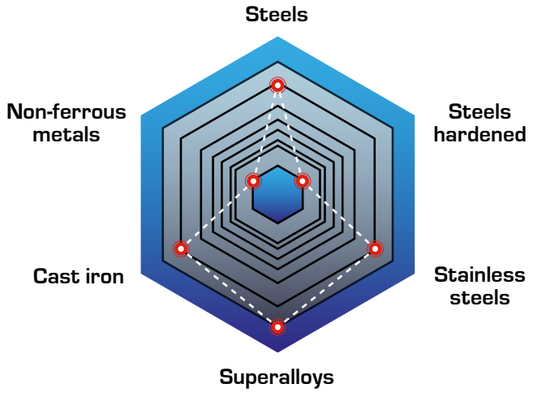
Signature Coating nACoX

Oxide nitride coating special for inserts

nACoX is the specialist for turning and milling with inserts under dry or MQL (Minimum Quantiy Lubrication) conditions. Based on his four layers and thickness range, nACoX is comparable to CVD coatings while using lower coating temperature. By adding oxygen into the coating, nACoX has an improved oxidization resistance. It has a wide range of usage, beginning from milling cold work steel and ending with turning of Inconel 718.

Highlights:
- Wear protection with chemical and thermal isolation, avoiding oxygen diffusion
- Decreasing friction at temperatures over 1,000 °C for reduction of build-up edges
- Sustainability by lower coating temperature than comparable CVD coatings

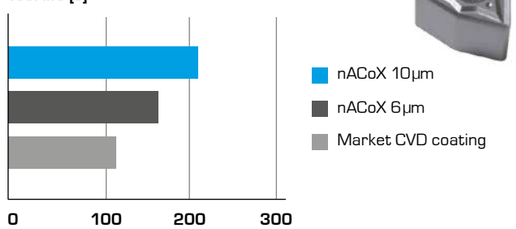
Charakteristics in cutting:



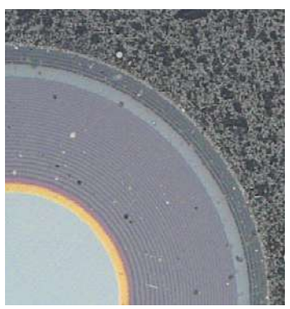
Specifications

Color	dark grey
Nano-hardness [GPa]	30–32
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.5
Coating thickness [µm]	4–10
Max. service temperature [°C]	1,200
Coating temperature [°C]	550–600
411 PLUS TURBO & OXI	(Ti, AlSi18, AlCr45, AlTi33)

Turning of ductile nickel alloyed steel:



Tool: Turning insert WNMG 080412
Workpiece material: Ni-steel
Coolant: MQL
vc = 110mm/min; f = 0.4mm; ap = 0.2 mm
Source: German automotive manufacturer



Calo 4 layers

TiN adhesion layer →
AlTiN core layer →
nACo core layer →
AlCrON top layer

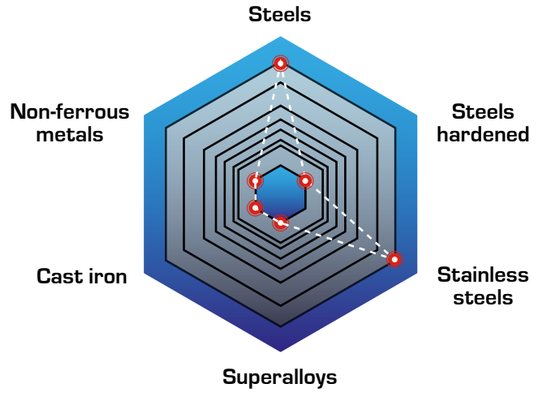
Signature Coating TapCT

SCIL® coating for tap forming

TapCT is characterised by a very smooth surface thanks to the SPUTTER process SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge). Thus, during tap forming, the friction between the tool and the workpiece material and the sticking of the material will be reduced, and the process reliability increased. Furthermore, the excellent coating adhesion will increase the performance.

Highlights:
- High process reliability
- Lower machining torque
- High quality of the formed tap

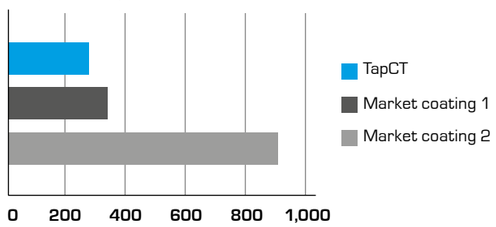
Charakteristics in forming:



Specifications

Color	silver
Nano-hardness [GPa]	28–30
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.4
Coating thickness [µm]	1–5
Max. service temperature [°C]	700
Coating temperature [°C]	400–450
411 PLUS SCIL	(LGD, -, -, CrTi50 SCIL)

Tap forming in a carbon steel:



Tool: HSS forming tap M6x1
Workpiece material: carbon steel
Coolant: emulsion
vc = 20 mm/min; depth of the hole 9.0 mm
Source: Asia tool manufacturer

TapCT

Dedicated Coating example FeinAl Plus

The next generation of the dedicated coating for fineblanking applications

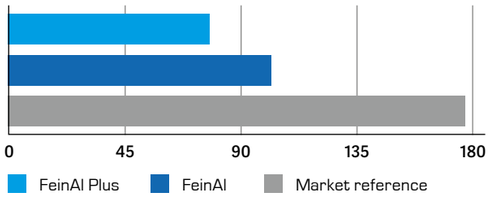
Longer tool life and higher tool efficiency: partner companies Blösch, Feintool and PLATIT release FeinAl Plus, a new generation of dedicated PVD coatings for fineblanking.

FeinAl set the market standard for PVD coatings of fineblanking tools over many years through its dedicated coating design and seamless integration in a process chain of customized pre- and post-treatment steps. Based on the proven concept of FeinAl and by adding several years of continuous development, the project partners announce the next level of coatings for fineblanking applications: **FeinAl Plus**

Numerous innovations lead to the unmatched tool performance of FeinAl Plus:

- Dedicated AlCr multilayer creating a tough and flexible coating structure
- Selective doping with boron, simultaneously reducing internal stress and increasing hardness
- Improved crack resistance and thus less chip welding inside the cracks
- Specialized edge rounding processes and post-polishing steps tailored to the substrate material, tool geometry, and coating design

Average wear comparison [µm]:
Average measured wear on tools from four different test series after up to 30,000 strokes



Tool: Internal forming punch; high-speed steel S390; hardness of 66 HRC
Coating thickness: 3.5 µm
Punching material: quality C60E; thickness 3 mm; tensile strength 560 MPa
Source: Feintool Technology AG

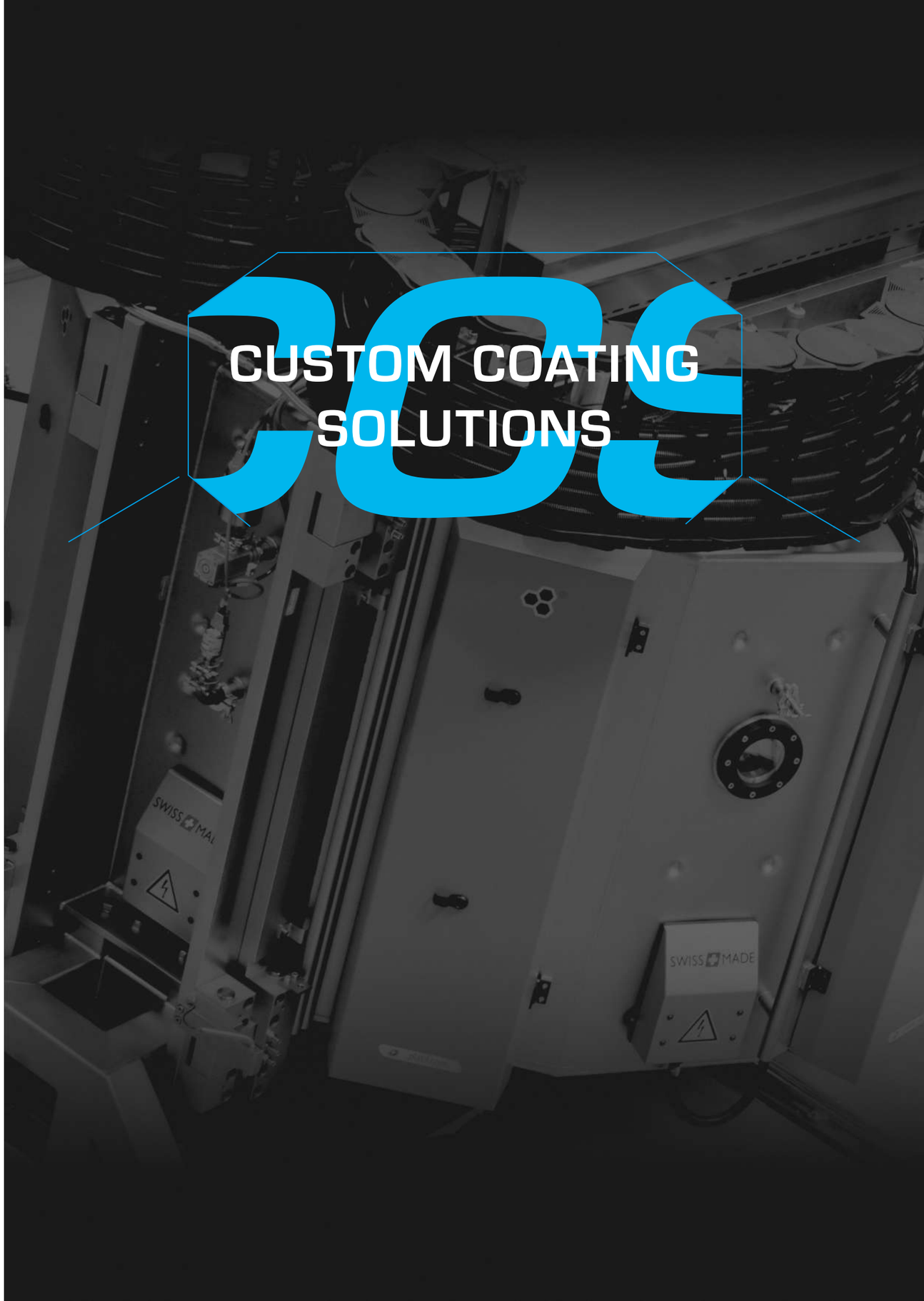
Blösch specializes in the processing and finishing of surfaces.

Feintool is the leading manufacturer and expert in fineblanking.

PLATIT manufactures high-tech PVD and PECVD coating units for tools and components.

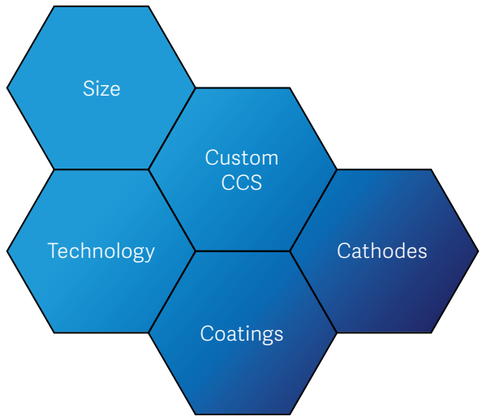
Specifications

Color	grey
Nano-hardness [GPa]	38–40
Coefficient of friction [µ] PoD (at RT, 50 % humidity)	0.3
Coating thickness [µm]	2.0–4.0
Max. service temperature [°C]	900
Coating temperature [°C]	400–500
Pi411 PLUS ECO	(Al, AlCrB20-10, Cr)
411 PLUS LACS®	(-, Al, Cr, TiB2 SCIL)



CCS – Custom Coating Solutions

PLATIT's Custom Coating Solutions meet any special requirements. They are user-defined in every respect:



Engineers and technicians from PLATIT in the CCS (Custom Coating Solutions) division in Switzerland advise customers and design, develop, manufacture and program systems according to the individual requirements. They develop solutions in close exchange with customers and accompany them over the years by providing support and supplying spare parts.

For this purpose, PLATIT has established a network of companies for cooperation in the production of components. PLATIT also manufactures special holders as well as handling devices and works together with various partners to offer peripheral equipment adapted to the Custom Coating Solutions.

For inspiration, the following pages show different sample applications for which PLATIT has already developed, manufactured and delivered coating systems.

Custom Coating Solutions

CCS for technological lead

Coating centers and manufacturers in various applications need to be flexible in coating high volume of small and large substrates together – from high-performance cutting tools to components and forming tools. This allows them to save time and costs per batch – without compromising coating performance.

PLATIT continuously adapts coating systems and their technologies to the current and future requirements. The PVD coating units that can produce such high-performance coatings are among the best in the world and are used by very successful high-tech manufacturing companies, regrinders as well as coating centers around the world.

Sample Custom Coating Solution_Pi1511

The Pi1511 is a high-volume PVD coating unit. It combines three rotating PLATIT LARC® XL cathodes positioned inside the door with two Planar ARC cathodes in the back of the chamber. The combination of round cathodes with high-performing Planar cathodes allows for the deposition of PLATIT Signature Coatings with familiar flexibility. The LARC® XL cathodes have a very long lifespan and thus guarantee high productivity at a low cost per tool. Customers with a strong focus on innovation and technology use the mix of planar and round cathodes in the Pi1511 to generate an exceptional performance advantage with the unique cathode configuration.

Highlights:

- Uniquely flexible cathode composition with three rotating and two planar ARC cathodes for exclusive performance benefits
- Fast cathode exchange and long lifetime of the LARC® XL cathodes (LAteral Rotating XL Cathode)
- MAC-3C (Magnetic ARC Confinement – Coil Current Compensation) for automated magnetic field adjustment to increase the lifetime of a target
- Possibility to develop in-house coatings
- User-friendly and intuitive software that meets the latest standards
- Focused on specific applications in Industry 4.0

Specifications_Sample Custom Coating Solution Pi1511

Technologies applied:

- 3 × LARC® XL (LAteral Rotating XL Cathode) inside the door and 2 × Planar cathode with ARC technology in the back
- MAC-3C (Magnetic ARC Confinement – Coil Current Compensation) for automated magnetic field adjustment
- Quick cathode exchange
- Deposition of PLATIT Signature Coatings

Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:

- Max. coating volume: ø 715 × H 805 [mm]
- Max. coating height with defined coating thickness: 711 mm
- Max. load: 750 kg; higher weight upon request

Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Statistics and help function via user interface
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:

- Footprint: W 5,000 × D 2,200 × H 2,500 [mm]

Targets	**Targets**	**Cycle**	**Max. Load**	**Solution**	**Service**
2	3	≥ 7 h	750 kg	Turnkey	Custom

CCS for Saw Bands

The biggest challenge in the handling as well as coating of saw bands is their size as they are wound on a tool carrier, the coil. Due to circumferential speed, layer growth can result in varying coating thickness.

PLATIT has mastered this problem by developing and manufacturing a Custom Coating Solution:

- To improve the handling, the coating chamber door opens sideways; the opened chamber door can be swiveled by 90° so the loading and unloading can take place from the left-hand side
- The coil is arranged at a certain angle to the deposition technology to ensure a constant coating thickness distribution
- The LGD® (Lateral Glow Discharge) process is used for etching and improved coating adhesion
- To guarantee a uniform coating, the teeth and the back of the saw band are coated by different cathode types
- The coating process takes place at a maximum temperature of 500 °C to ensure that the physical and chemical properties of the saw band remain unchanged
- Coating increases the lifespan of saw bands and improves the cutting performance during sawing; the development of tool wear is reduced

Sample Custom Coating Solution_Pi603

In order to meet the product-specific requirements, PLATIT has designed a turnkey system with a PVD coating unit operating at a high vacuum as well as a tailor-made single-chamber cleaning system. The saw bands are wound as a coil and are both cleaned and coated with the same product carrier to avoid additional effort.

The Pi603 was built in 2006 and is still working perfectly today. PLATIT's design proved to be very userfriendly. Even customers who are not experienced with such technologies can operate this unit with ease. Pursuant to the open-source principle, PLATIT has transferred its knowledge to the customers so that they can benefit from the advantages of LARC® cathodes and flexibly combine as well as develop their own coatings.

Specifications_Sample Custom Coating Solution Pi603

Technologies applied:

- 3 × LARC® cathode by PLATIT with ARC technology
- 1 × Planar ARC cathode for uniform coating of the backs of saw bands

Etching technologies applied:

- LGD®
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:

- 2 batches / day with a batch time of 7.5 – 9 h
- Saw band diameter up to 1,360 mm
- Inner packing diameter: 560 mm
- Saw band height up to 100 mm
- Saw band weight incl. carrier up to 600 kg

Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:

- Footprint: W 5,900 × D 6,450 × H 3,100 [mm]

CCS
Pi603

Targets	Targets	Cycle	Max. Load	Solution	Service
3	1	≥ 7.5 h	600 kg	Turnkey	Custom

CCS for Saw Blades

When it comes to coating saw blades, the biggest challenge is to find a coating unit that can efficiently coat large quantities in a single batch at a high level of quality without damaging the saw blades. Due to their high content of heat-sensitive steel, accurately controlling the process temperature is essential. If the process temperature is too high, the saw blade deforms and thus loses its cutting force.

PLATIT designs special coating units to meet these challenges:

- The PVD unit has a temperature control system for coating saw blades; the temperature is kept within a very narrow range
- The use of ARC power supplies on alloyed targets improves the deposition rate and coating distribution, ensures uniform erosion and extends the target material's lifespan
- Pulsed cathodes and improved ARC distribution produce smoother coatings
- The coating chamber is suitable for large tools and substrates
- The modular carousel design provides maximum loading flexibility

A rail system ensures that the carousel trolley is always correctly aligned with the chamber, thereby making the loading and unloading of loads of up to 1800 kg easy. The height of the custom-designed carousel trolley can be adjusted at the touch of a button.

CCS
PL2011

Sample Custom Coating Solution_PL2011

For the coating of large saw blades up to a ø of 1,423 mm (56"), PLATIT has built a high-capacity coating unit. A custom-designed carousel with 6 configurations allows for maximum loading flexibility while maintaining the quality of the coating. Tools with a small or large diameter or mixed loads can be coated in one batch.

The unit is equipped with two doors to provide:

- Optimal access to the chamber
- Simplified maintenance of both the machine and the cathodes
- Simplified batch management since a completed batch can be removed through one door and the next batch loaded immediately via the other door

Specifications_Sample Custom Coating Solution PL2011

Technologies applied:

- 6 × Planar ARC cathode, 4 of which pulsed with ARC power supplies

Etching technologies applied:

- LGD® (Lateral Glow Discharge) with 2 cathodes with a shutter and 2 cathodes acting as anodes
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

Load and cycle times:

- Coating volume up to ø 1,400 × H 700 [mm]
- Load up to 1,800 kg

Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:

- Footprint: W 8,000 × D 5,800 × H 2,350 [mm]

2–5 batches / day for*:			
Saw blade (2.5 µm), 1fold rot.	Max ø 1,400 [mm] / 55 inch	20 pcs.	8 h
Saw blade (2.5 µm), 2fold rot.	Max ø 460 [mm] / 18 inch	150 pcs.	8 h
Saw blade (2.5 µm), 2fold rot.	Max ø 650 [mm] / 25.5 inch	75 pcs.	8 h
Saw blade (2.5 µm), 2fold rot.	Max ø 350 [mm] / 13.7 inch	200 pcs.	8 h
Saw blade (2.5 µm), 2fold rot.	Max ø 250 [mm] / 9.8 inch	250 pcs.	8 h
Saw blade 1.6 mm / 0.06 inch (5 µm), 1fold rot.	5 x Coil: ø 400 – ø 680 [mm] ø 15.7 – ø26.7 inch	320 pcs.	8 h
Shank tools (2 µm), 4fold rot.	ø 8 x 70 [mm] ø 0.31 x 2.7 inch	3,888 pcs.	≈ 11 h
Inserts (3 µm), 4fold rot.	ø 12 x 4 [mm] ø 0.47 x 0.15 inch	45,360 pcs.	≈ 13 h

* Average cycle times in an ongoing production with max. number of cathodes in use.

Targets	Cycle	Max. Load	Solution	Service
6	≥ 8 h	1,800 kg	Turnkey	Custom

CCS for Rollers

Because of their weight, large sizes and special geometry, rollers are difficult to handle and not suitable for coating in standard coating units. The coated surface must be defect free and prevent the workpiece material sticking on the tool.

PLATIT develops Custom Coating Solutions tailored to special applications:

- The unit is set to lower system temperatures for heat-sensitive tools and machine components made of high-speed steel
- The vacuum system is further developed for steady coating thickness distribution for large chamber volumes
- Smoothest surface and micro-hardness uniformity of the coating is enabled by pulsed DC coating technology
- The design and handling concept can be flexibly adapted to the weight and size of the tools, ensuring easy operation and maximum user comfort; target change is uncomplicated

Sample Custom Coating Solution_Mega-PiMS

PLATIT has designed a Custom Coating Solution with simplified loading in which the rollers are positioned horizontally. The cathode is located at the bottom of the coating chamber. PLATIT's SPUTTER technology is used to guarantee smooth coatings for high-gloss-polished or textured surfaces.

CCS
Mega-PiMS

Specifications_Sample Custom Coating Solution Mega-PiMS

Technologies applied:

- 1 × SPUTTER cathode
- 1 × anode on the opposite side

Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge

Load:

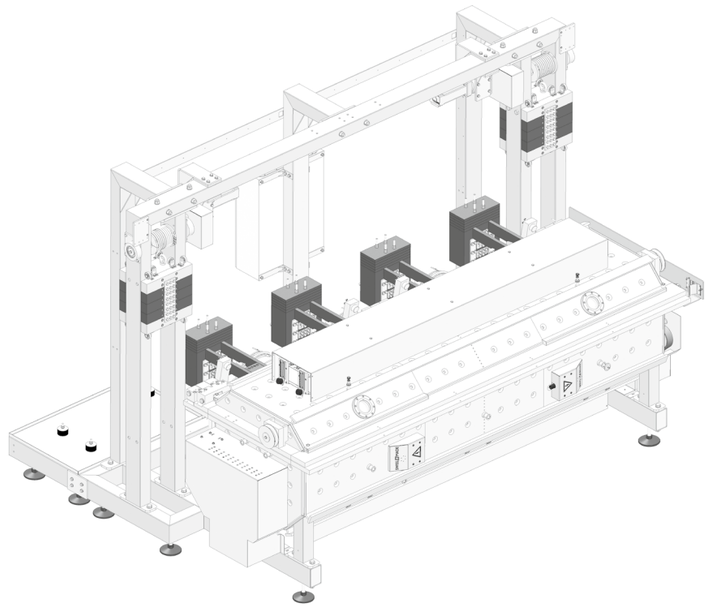
- Coating volume up to ø 600 × L 3,000 [mm]
- Coating volume with defined coating thickness up to ø 600 × L 2,000 [mm]
- Load up to 1,000 kg; higher weight upon request

Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Statistics and help function via user interface
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:

- Footprint (coating unit with electrical cabinet): W 4,100 × D 2,900 × H 2,700 + W 1,900 × D 1,100 × H 2,200 [mm]



Targets
1

Max. Load
1,000 kg

Solution
Turnkey

Service
Custom

CCS for Coin Minting Dies

Custom Coating Solution for Coin Minting Dies

When coating stamps, punches and coin minting dies, ensuring surface quality is essential. These surfaces require smooth, dustless coatings with excellent adhesion to accurately replicate highly detailed relief structures. The requirements increase when minting dies are used to produce proof coins, where temperature-sensitive materials are often used. They have narrow tolerances and can only be coated within a certain temperature range.

For coin minting dies, PLATIT has developed a Custom Coating Solution for high-quality coatings with a strong amorphous structure as well as high density, surface quality and reproduction accuracy.

Highlights:
- Built for the highest demands towards the surface of proof coins
- Full temperature control for temperature sensitive substrates
- Specific holders developed for various stamp sizes and geometries or customized upon request
- Guaranteed smooth dust-free coatings, since the surface to be coated faces downwards; the target is placed on the bottom of the coating chamber
- SPUTTER technology from PLATIT, supported by LGD® (Lateral Glow Discharge) ensures very good adhesion; thus, there are no droplets and no layer defects

Specifications_Sample Custom Coating Solution S-MPuls

Technologies applied:
- 1 × DC-pulsed magnetron SPUTTER cathode with a rotating magnetic field
- SPUTTER source arranged at the bottom of the chamber

Etching technologies applied:
- LGD®
- Plasma etching with argon, glow discharge, with auxiliary anode

Load and cycle times:
- Batch time of 3–4.5 h
- Coating diameter with defined coating thickness: ø 70–250 [mm]
- Substrate holder: ø 300 mm, varying customer-specific versions possible
- Load up to 20 kg

Software:
- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Statistics and help function via user interface
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

Machine dimensions:
- Footprint (coating unit with electrical cabinet): W 945 × D 1,403 × H 2,068 + W 608 × D 1,369 × H 2,068 [mm]

CCS
S-MPuls

Targets	Cycle	Max. Load	Solution	Service
1	≥ 3 h	20 kg	Turnkey	Custom

Ceramicoin

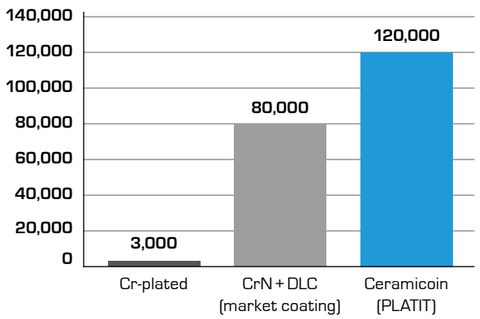
Dedicated PVD coating for coin minting dies

Ceramicoin, deposited with S-MPuls, replicates every detail of the surface and is thus a significant advantage for coin appearance and design features.

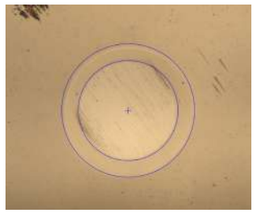
Quality features of Ceramicoin:
- Surface quality
- Durability
- Smoothness
- Coating adhesion
- Replication of every detail
- Extended die life

Advantages of PVD technology compared to Cr-plating:
- No hexavalent chromium
- No noise
- No chemicals
- No contamination
- No fumes
- No toxic waste
- No risk for your health

Coins / Die

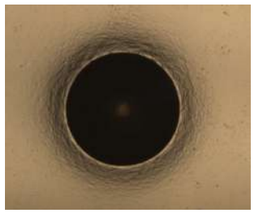


Grinding image



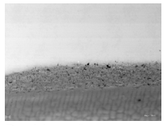
Thickness total: 1.05 µm

Rockwell image



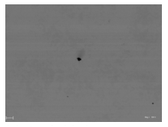
Adhesion class: HF 1

Highlights:
- Coin minting dies ready to use
- No post-polishing needed
- No post-cleaning needed
- Fast cycle times: < 4 h
  - Pumping, heating: ~ 60 min
  - Etching: ~ 35 min
  - Coating: ~ 40 min
  - Cooling, venting: 30 – 60 min



Residues from engraving (oxides)

Residues from polishing



Material inhomo-geneities (pores or carbides)

Specifications

Color	satin silver
Nano-hardness [GPa]	32
Coefficient of friction [µ] PoD (at RT, 50% humidity)	0.4
Coating thickness [µm]	1
Max. service temperature [°C]	600
Coating temperature [°C]	200

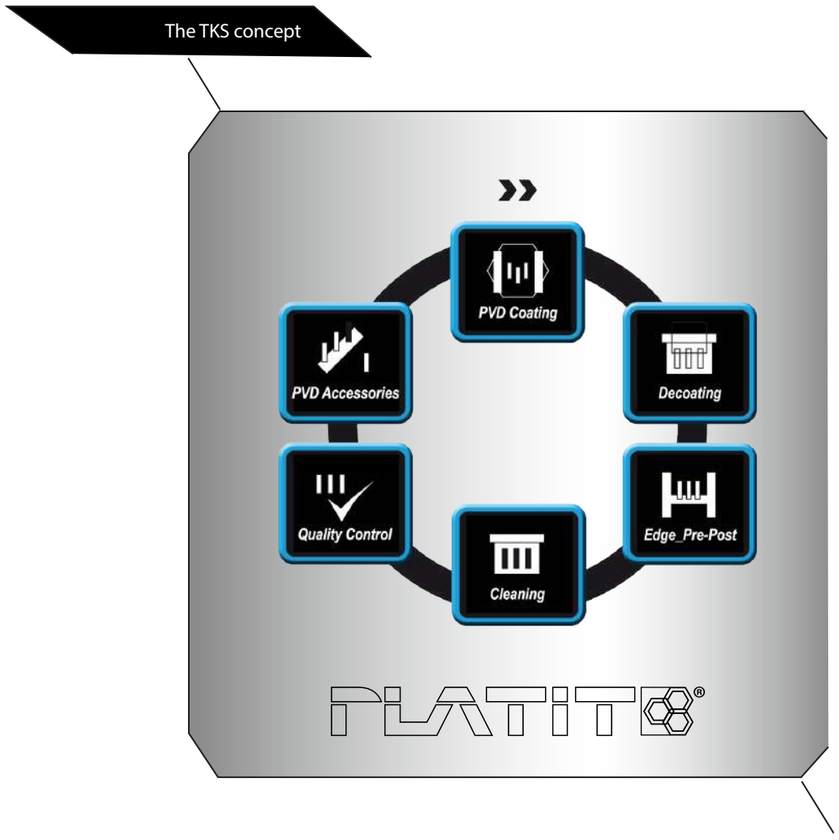
View inside the coating chamber with up to 40 coin minting dies per batch:

The TKS concept

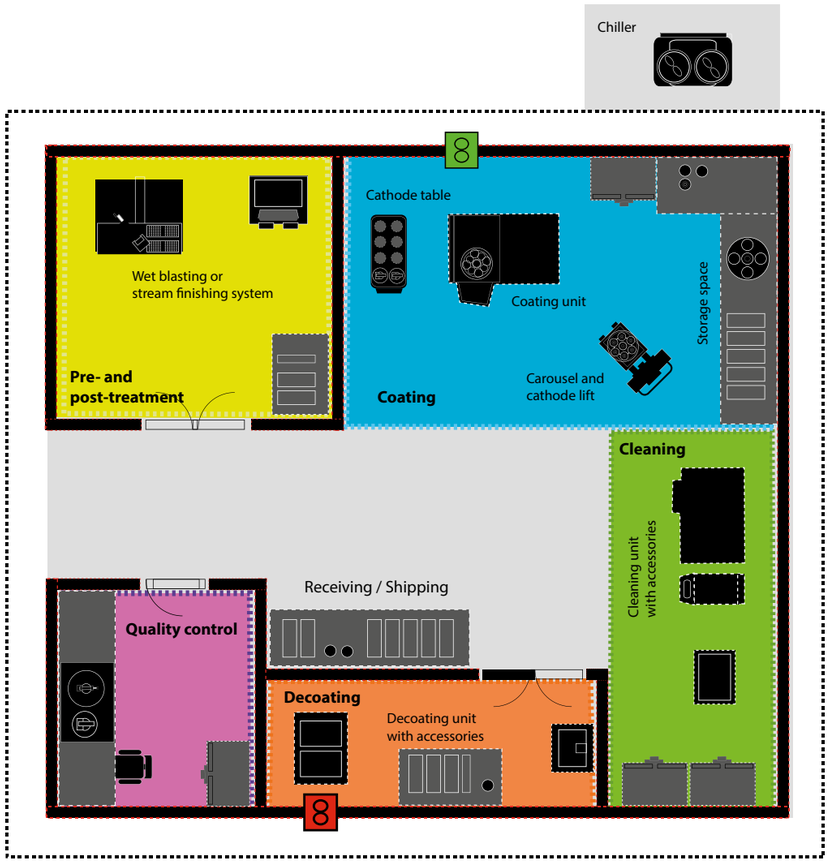
PLATIT's turnkey system with complete solutions for upstream and downstream steps for hard coating is ideally suited for seamless integration into the tool manufacturing and regrinding process. As a partner for its customers, PLATIT takes responsibility for the functionality of the whole system.

PLATIT provides and integrates everything needed for a successful coating center:

- Depending on the requirements, different dimensions of coating chambers for the coating of small to oversized substrates
- Comprehensive coating know-how
- Equipment for decoating high-speed steel and carbide
- Equipment for edge pre-treatment
- Vacuum-assisted single-chamber cleaning units
- Systems for easy quality control of the coating
- Equipment for post-treatment, such as polishing
- PVD production accessories from sleeves to handling systems and chillers



PLATIT cooperates with partner companies to offer a wide range of peripheral equipment for upstream and downstream steps of the coating process. Flexibly tailored to the various applications, PLATIT's processes are integrated into its customers' tool manufacturing and thus guarantee an independent, stable and innovative production process.



Typical workflow in a coating center with PLATIT's turnkey solutions:

1. Receipt of goods
2. Preliminary cleaning
3. Optional: decoating
4. Optional: edge pre-treatment
5. Fine-cleaning
6. Preparation for coating
7. Coating
8. Unloading of a batch
9. Optional: post-treatment
10. Quality control
11. Goods output

Some modules (decoating, pre- and post-treatment) should be set up in a separate room from the coating units. Chiller must be placed separately.

Decoating

Decoating/stripping is an important prerequisite for recoating at a high level of quality. The old, used coating is removed so that the new one will adhere well to the reground tool and achieve a high degree of performance. Regrinding without decoating leads to a reduction of the tool's lifespan.

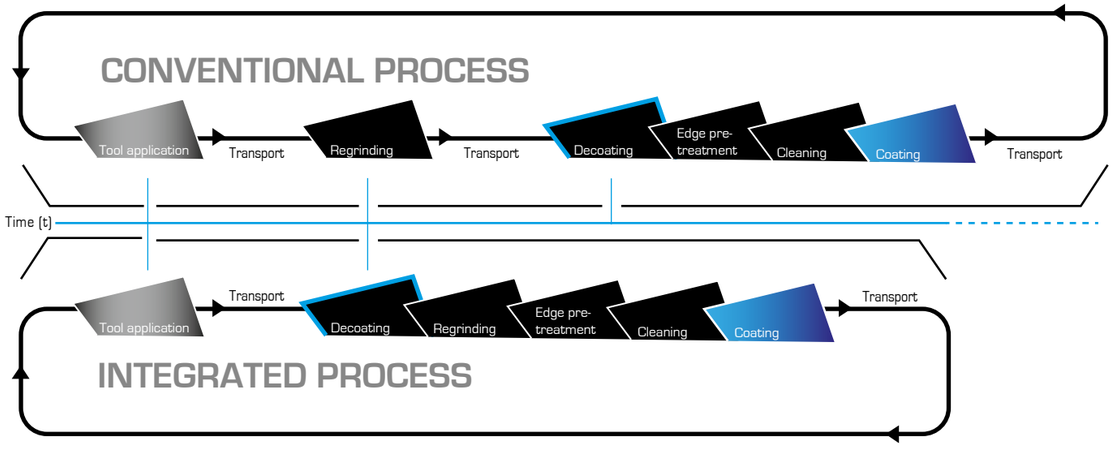
Conventional process

In coating centers, tools are usually decoated after regrinding. However, decoating after regrinding can damage the final geometry of the tool and increase the risk of poor adhesion. In addition, packaging, transport and repackaging involve the risk of damaging the tool.

Integrated process

By integrating the decoating process into the tool regrinding, decoating can take place before the regrinding.

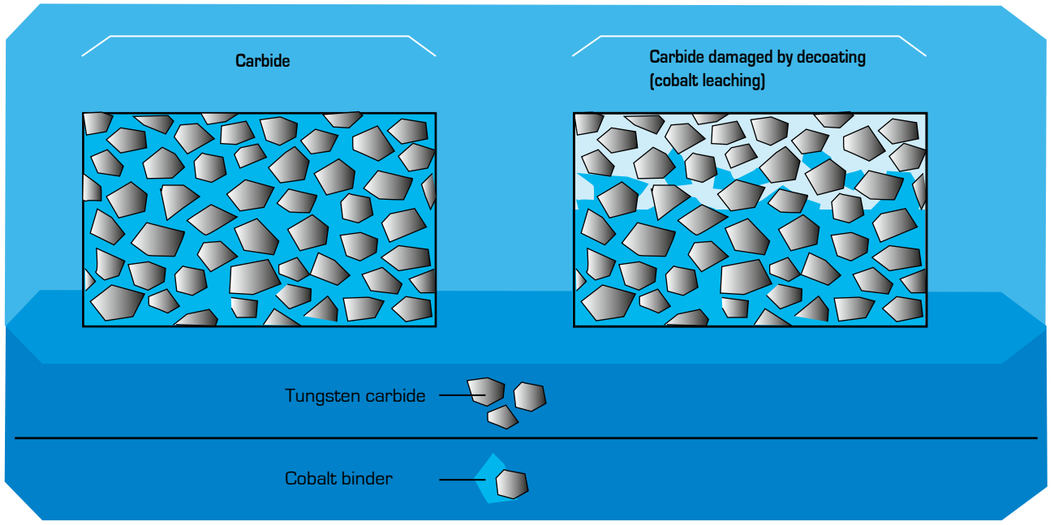
Advantages:
- Elimination of transport and packaging
- Less damage caused by handling
- Chemical destruction after regrinding is prevented
- Edge pre-treatment is fully effective
- Adhesion is optimized
- The tool performs almost as well as a new one



In decoating carbide, the biggest challenge is to avoid damaging the substrates. The most common damage is caused by cobalt leaching.

Cobalt leaching refers to the removal of the cobalt binder from the top layer of the carbide. The most common reasons are:
- Chemical decoating
- Aqueous cleaning
- Water-cooled grinding
- Grinding too fast with a blunt grinding wheel

The coating of cobalt-leached carbide is not effective. Although the coating will adhere well to the top tungsten carbide layer, the tungsten carbide, along with the coating, will not adhere to the base material due to the lack of cobalt binder.



PLATIT_Decoating unit concepts

PLATIT offers two types of decoating units – for carbide and high-speed steel – which can be customized according to the customer's requirements.

Decoating

PLATIT CT20 (patented)_Ultra-fast decoating unit

CT decoating systems from PLATIT set new standards in decoating, especially for carbide tools. The problem of cobalt leaching is circumvented by protecting the substrate with a TiN adhesion layer as the decoating process of the CT systems will not attack the TiN layer. For the CT20, the decoating cycle all the way to the TiN adhesion layer will take less than three minutes.

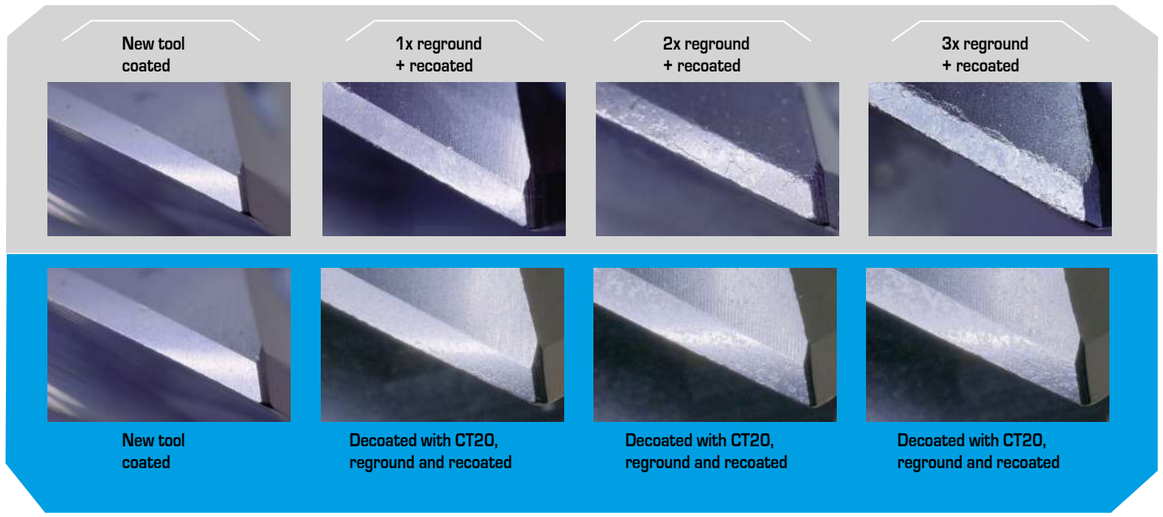
The end of the process is automatically detected by built-in electronics. The adhesion layer is not removed and therefore "overcoated" after regrinding and pretreatment. A service life comparable to that of a new tool is achieved.

Features:

- The new environmentally friendly wet chemical carbide decoating unit from PLATIT
- Fastest decoating process worldwide
- Decoating time is less than 3 minutes all the way to the TiN adhesion layer and the decoating cycle stops automatically at the TiN adhesion layer
- A single recipe for a wide variety of nitride coatings with a TiN adhesion layer, independent of tool size
- Multiple coatings can be removed as well
- Special holders for shank tools, hobs, inserts etc. to avoid attacking uncoated areas
- Max. tool dimensions: ø 200 × 250 mm
- Common chemicals available worldwide
- The process takes place at room temperature, neither heating nor cooling is required
- The end of the process will be automatically detected, which greatly simplifies the operator's work

	Pi111	Pi411	PL711	PL1011	⏱
TiN	N	N	N	N	
TiCN	N	N		N	
TiAlN	Y	Y		Y	3 min*
TiAlCN		Y		Y	3 min*
AlTiN	Y	Y		OPT	3 min*
CrN	OPT	OPT	N	OPT	2 min*
CrTiN	Y	Y		Y	3 min*
TapCT		Y			3 min*
ZrN	Y	Y		Y	2 min*
AlCrN		OPT			2 min*
Omnis		N		N	2 min*
AlTiCrN	Y	Y		N	3 min*
nACo	Y	Y		N	3 min*
nACRo	N	OPT			3 min*
TiXCo3	N	Y		N	3 min*
TiXCo4		Y			3 min*
PSiX		N		N	3 min*
BorAC		OPT			2 min*
TiBor		N			

* Up to the TiN adhesion layer
⏱ Decoating time for 2 µm, ø 10 mm
Y = can be decoated with CT20/N = cannot be decoated with CT20
OPT = optionally decoatable if TiN adhesion layer is applied
Empty = no standard recipe for the coating unit available



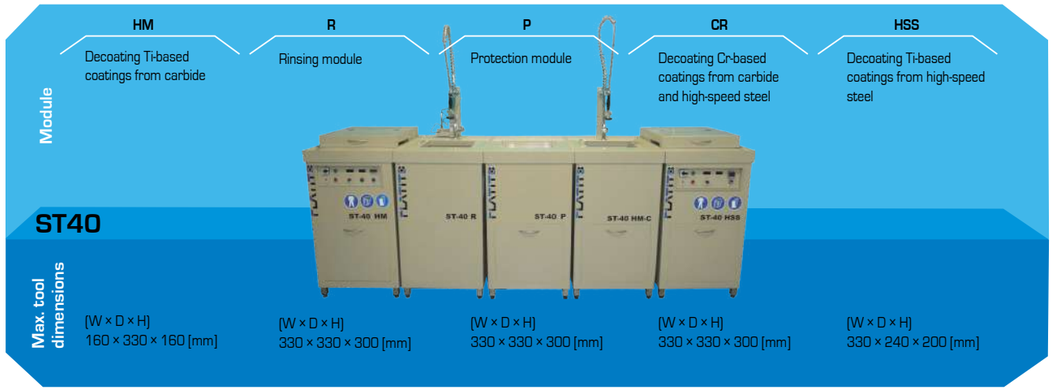
Without decoating, roughness increases and tool life decreases
Roughness and tool life remain constant, if the tool gets decoated with PLATIT CT20 before regrinding

Decoating

PLATIT ST40_Conventional decoating units

ST decoating units from PLATIT stand for great safety and flexibility.

Depending on the module, they decoat Ti- or Cr-based coatings on carbide or high-speed steel.



ST40_Carbide shank tools:

Coating	A1	B	C
TiN	4–5 h	T-HM	HM
TiCN	6–8 h	T-HM	HM
TiAlN	10–18 h	T-HM	HM
TiAlCN	-	-	-
AlTiN	10–18 h	T-HM	HM
CrN	0.5–3 h	C	CR
CrTiN	-	-	-
TapCT	-	-	-
ZrN	-	-	-
AlCrN	0.5–2 h	C	CR
Omnis	1–2 h	T-HM	HM
AlTiCrN	-	-	-
nACo	9–11 h	T-HM	HM
nACRo	0.5–2 h	C	CR
TiXCo3	5–9 h	T-HM	HM
TiXCo4	-	-	-
PSiX	10–18 h	T-HM	HM
BorAC	-	-	-
TiBor	1–2 h	T-HM	HM

ST40_High-speed steel hobs:

Coating	A2	B	C
TiN	~ 1 h	T-HSS	HSS
TiCN	~ 2 h	T-HSS	HSS
TiAlN	1–2 h	T-HSS	HSS
TiAlCN	-	-	-
AlTiN	1–2 h	T-HSS	HSS
CrN	0.5–3 h	C	CR
CrTiN	-	-	-
TapCT	-	-	-
ZrN	-	-	-
AlCrN	0.5–2 h	C	CR
Omnis	1–2 h	T-HSS	HSS
AlTiCrN	-	-	-
nACo	0.5–2 h	T-HSS	HSS
nACRo	0.5–2 h	C	CR
TiXCo3	1–3 h	T-HSS	HSS
TiXCo4	-	-	-
PSiX	1–2 h	T-HSS	HSS
BorAC	-	-	-
TiBor	1–2 h	T-HS	HSS

A1 Decoating time for 2 µm, ø 10 mm

A2 Decoating time for 2 µm, ø 80 x 180 mm

B Decoating recipe*

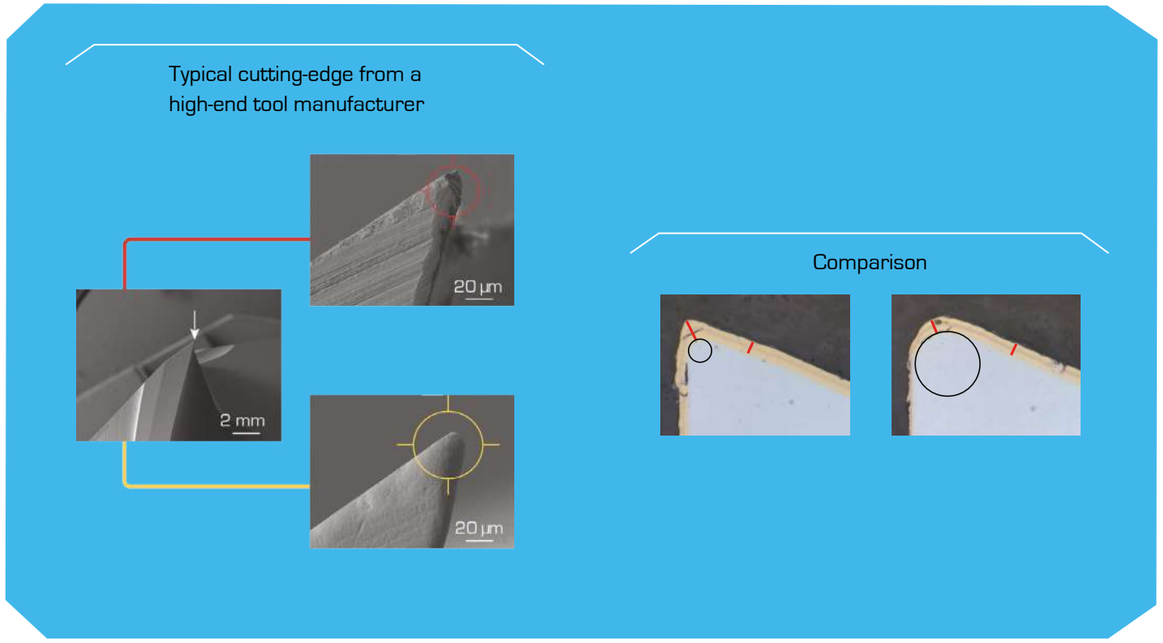
C Module

* Different decoating chemicals available through the worldwide distribution network of Borer AG, Zuchwil, Switzerland
- = cannot be decoated in conventional decoating units

Edge pre-treatment

The edge pre-treatment is a very important process in a turnkey system designed to utilize the full potential of a coating.

The main aim of edge pre-treatment is to increase the edge's stability and thus the tool's performance.

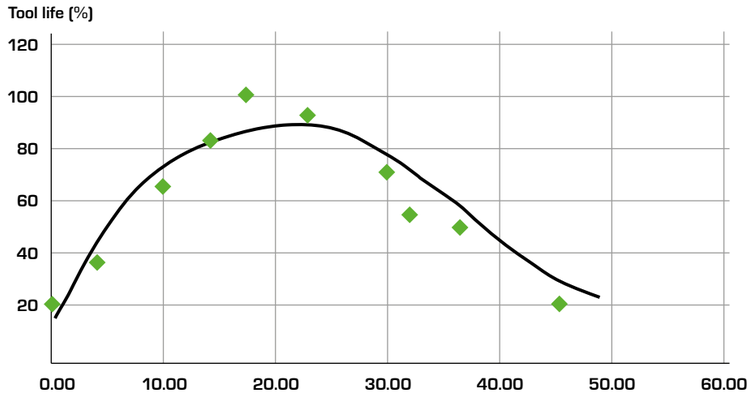


Advantages of cutting-edge rounding:

- Reduces chipping
- Reduces what is referred to as an "antenna effect" in PVD coatings on sharp edges and thus reduces the stress in the coating
- The more an edge is rounded, the thicker the coatings can be
- Higher cutting-edge stability
- Avoids cutting-edge breakouts and flaking of the coating during the machining process
- Increase of the tool's lifespan despite a "blunt" cutting-edge

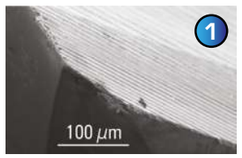
Edge pre-treatment

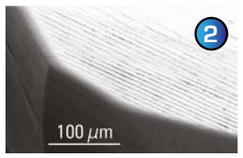
Influence of cutting-edge rounding when milling high-alloy steel

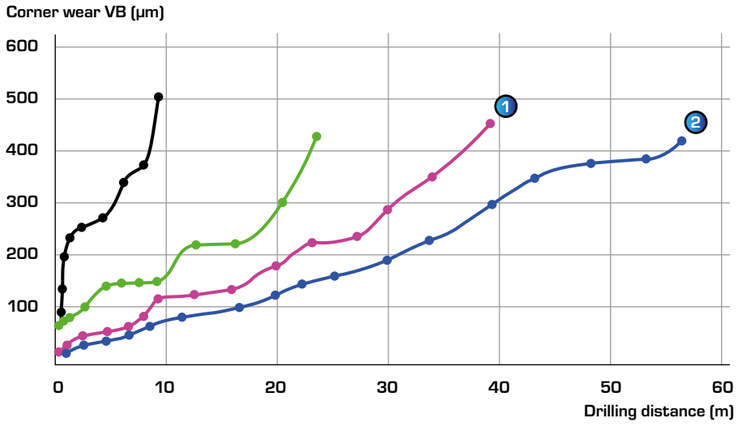


Tool: end mill, D10, z = 4
Workpiece material: 1.2379; X155CrVMo12-1
ap = 1.5 × d
ae = 0.25 × d
vc = 150 m / min
fz = 0.05 mm / z
Source: GFE, Germany
Coating: nACRo

Influence of cutting-edge rounding when drilling







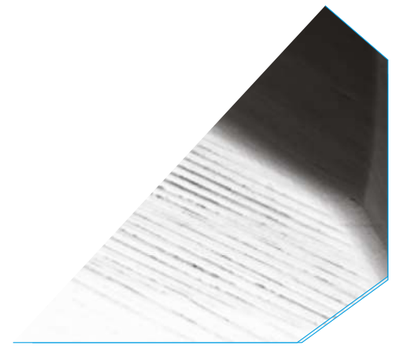
Tool: blind holes; VHM drill; D5
Workpiece material: cold work steel; 1.2379; X155CrVMo12-1; HRC22
Cooling: dry air
ap = 15 mm
vc = 75 m / min
fz = 0.15 mm / z
Coating: nACo

Methods of edge pre-treatment

Different materials and tools require different methods of edge pre-treatment. Below is an overview of the most common ones:

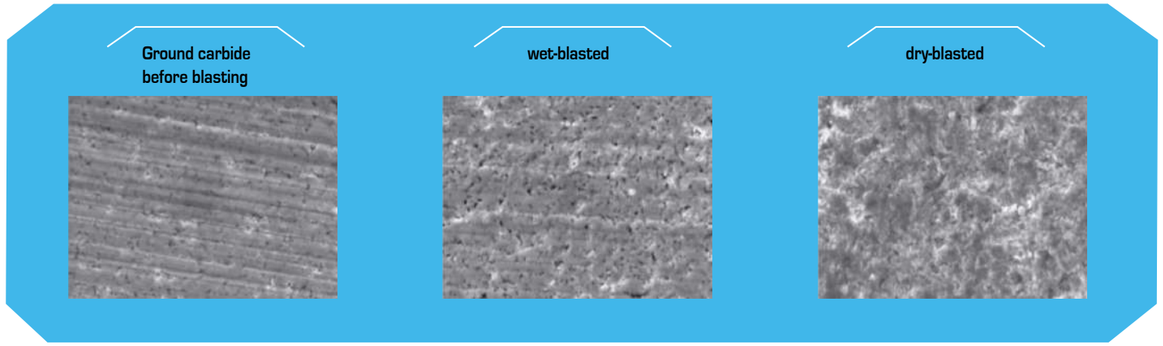
Method		Dry blasting	Wet blasting	Stream finishing	Brushing	Magnet finishing
Tool type	Drills	+	++	++	+++	+++
	End mills	+	++	+++	+++	+++
	Inserts	++	+++	+	++	+
	Hobs	++	+++	+	+	-
	Punches	+	+++	+++	-	-
	Molds and dies	+++	+++	-	-	-
Characteristics	Stability	+++	+++	+++	+++	+++
	Flexibility	+++	+++	++	++	++
	Productivity	+	+++	++	++	++
	Groove polishing possible	Limited	Yes	Yes	Yes	Limited
	Automation solutions possible	Yes	Yes	Yes	Yes	Yes
	Special characteristics	Blasting media sticks to the surface	Universally usable	Smooth surface	Individual treatment for cutting-edges and surfaces possible	Especially for micro tools

+++ High quality and high efficiency
++ High quality or high efficiency
+ Low quality and / or low efficiency
- Not suitable for the system



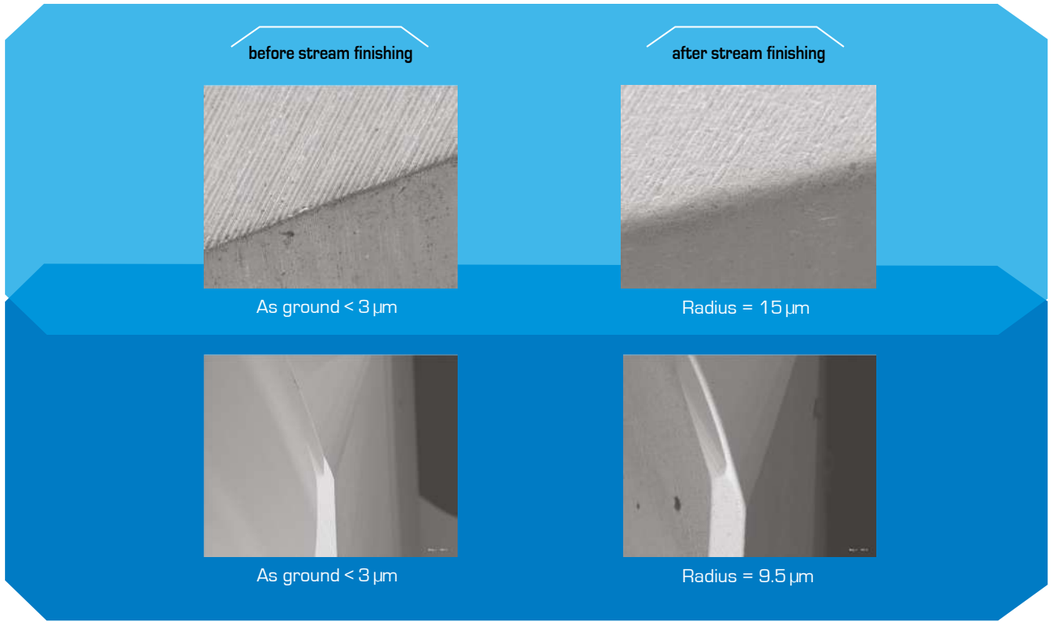
Edge pre-treatment

Comparison of wet and dry blasting

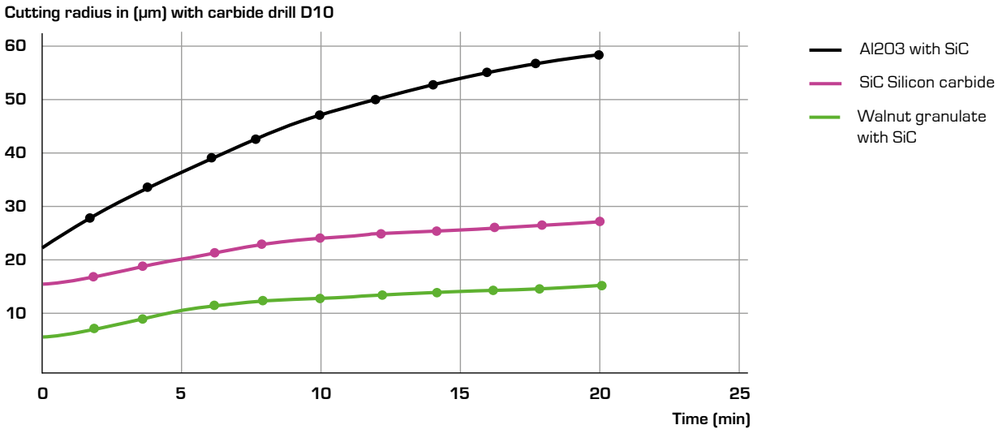


Comparison	Wet	Dry
Surface roughness	Sa = 0.05 µm; Sz = 0.32 µm Slightly shiny surface	Sa = 0.11 µm; Sz = 1.14 µm
Residual material after blasting	Risk of cobalt leaching due to the water	Smearing of the residual material
Coating adhesion	HF1	HF1 – HF3
Edge rounding	Good to control	Difficult to control
Grain size	Mesh 320 (50 µm), coarse, for edge rounding Mesh 400 (37 µm), medium, for surface activation Mesh 500 (30 µm), fine, for polishing	
Typical micro-blasting time [min] for hobs ø 80 mm; R = 10 µm	3	6
Advantages and disadvantages	Pre-cleaning not necessary	Pre-cleaning necessary
	Drying needed after blasting	No need for drying after blasting
	Difficult to clean after interruption	Easy handling even after interruption
	Fewer abrasive inclusions in the tool surface	More abrasive inclusions in the tool surface
	Low surface roughness at the same edge rounding	High surface roughness at the same edge rounding

Cutting-edge rounding and surface quality



Depending on the required edge rounding, different media are applied.



Cleaning

A clean metallic surface is necessary for coating. Contamination such as grinding residue, oil or dust weaken the coating's adhesion.

The industrial single-chamber cleaning units from PLATIT are the result of a partnership with Eurocold:

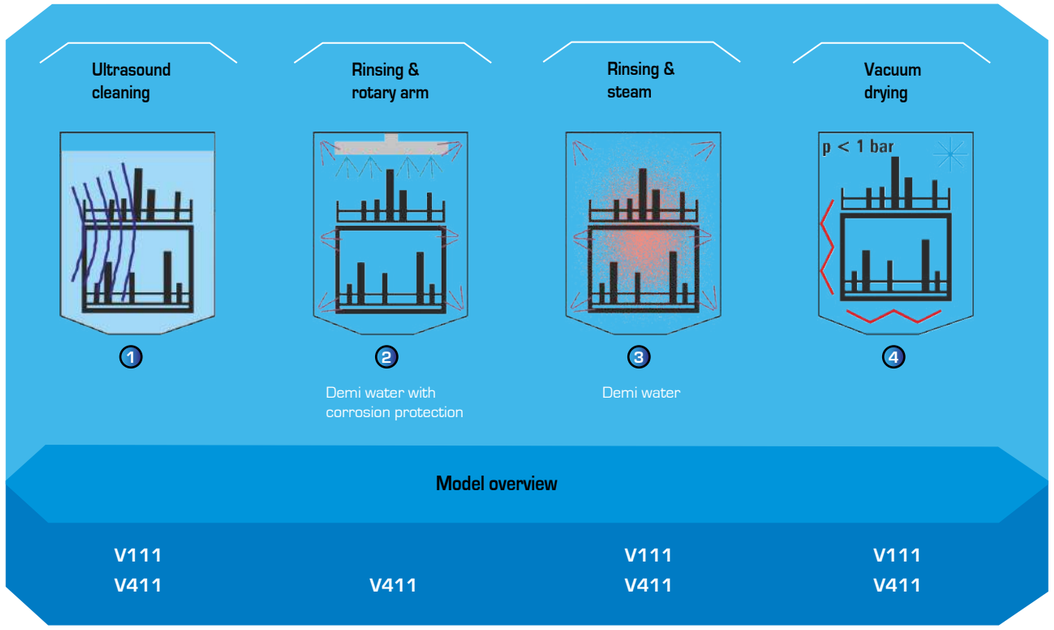
- Chamber sizes adapted to coating units by PLATIT
- Fully automatic cleaning process including vacuum drying
- Intuitive touch screen with real-time process parameters
- Remote diagnosis and maintenance
- Independent of environmental conditions as the system is closed

PLATIT offers two different standard sizes of single-chamber cleaning units, which can be tailored to individual customer needs on request, e.g. in terms of:

- Number of cleaning baths
- Bath filtration
- Immersion rinsing
- Tool sizes

Cleaning unit	V111	V411
Chamber volume [mm]	W 350 × D 390 × H 480	W 500 × D 500 × H 500
Loading for shank tools ø 10 × 70 [mm]	504 pcs.	1,008 pcs.
Max. load [kg]	150	200
Cycle times [min]	Approx. 45	Approx. 45

Cleaning cycle



Advantages of a single-chamber cleaning unit compared to a cleaning line

	Single-chamber cleaning unit	Cleaning line
Footprint	Compact	Very big (long)
Sensitive to environment	No	Yes (lower with housing)
Evaporation	No	Yes
Ventilation necessary	No	Yes
Controlled atmosphere	Yes	Limited
Throughput (with the same bath size)	Low	High
Detergent selection	Limited	Full flexibility
Detergent carry-over	No	Yes
Oscillation	No	Yes
Heavy tools	Easy handling	Depends on crane
Investment	Medium	High
Energy consumption	Medium	High

Quality control

Thickness and adhesion are important characteristics of a coating. They need to be controlled and monitored to guarantee a constant level of performance.

PQCS_PLATIT Quality Control Software

PQCS is a quality control software developed by PLATIT. The software is optimized for easy and fast data acquisition by recording batch photos, coating thickness and adhesion. All data is stored in a database to generate a coating report and provide a graphical representation of quality trends.

Advantages:
- Simple user interface
- Generating a coating report step by step to record the coating quality
- Automatic database entries including customer information, batch information and a photo, calo and Rockwell image, as well as adhesion report with scratch tester
- User-defined fields can be integrated
- The data can be filtered and represented graphically to recognize quality trends

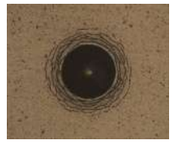
Methods for quality control

The basic quality control methods of a PVD coating are:
- Coating thickness measurement using a calo tester on test plates and tools
- Adhesion evaluation using a Rockwell or scratch tester

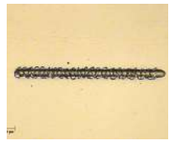
Products and integration services available from PLATIT.

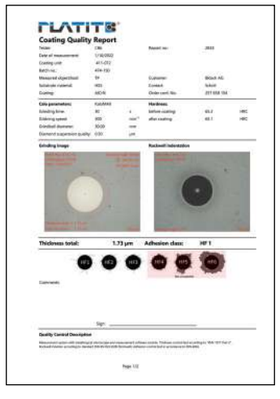
Calo test

Rockwell test



Scratch test





Coating report

Post-treatment

Objectives of post-treatment

- Removal of droplets after coating
- Reduction of surface roughness
- Improved chip flow for cutting tools

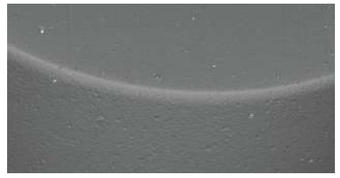
One of the problems that can arise without post-treatment of the surfaces is the jamming of the chips, which can cause a tool such as a drill to break.

Overview of the most common post-treatment methods

Method		Wet blasting	Stream finishing	Polishing
Tool type	Drills	+++	++	+++
	End mills	+++	+++	+++
	Inserts	+++	+	+
	Hobs	+++	+	-
	Punches	+++	+++	+++
	Molds and dies	+++	+	+++
Characteristics	Stability	+++	+++	-
	Flexibility	++	+	+++
	Productivity	+++	++	+
	Groove polishing possible	+	++	+++
	Droplet removal possible	+	++	+++
	Automation solutions possible	Yes	Yes	No
	Special characteristics	Universally usable	Smooth surface	Very smooth surface

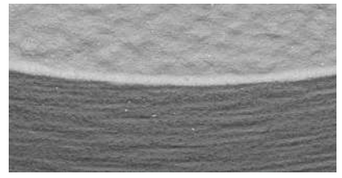
+++ High quality and high efficiency
++ High quality or high efficiency
+ Low quality and/or low efficiency
- Not suitable for the system

If the post-treatment is too intense, the edge will become exposed. This will lead to:
- Immediate full and direct contact of the cutting-edge with the workpiece material
- Low thermal and chemical insulation
- Low coating thickness near the cutting-edge
- A larger cutting-edge radius, which results in a larger surface area without coating
- The impression of a defective coating



Punch coated

Punch coated and wet blasted



Punch polished

PLATIT'S LIFECYCLE MANAGEMENT

World Wide Service

PLATIT® π - Series

Service throughout the entire life cycle of your unit

At PLATIT, you enjoy service that leaves no questions unanswered. Whether you need spare parts or new cathodes, advice or upgrades: Our experts will make sure that your coating unit operates optimally at all times, ensuring that you achieve the best possible coating performance.

WWS PLATIT
World Wide Service

Spare parts for your PVD unit

Unwanted downtime of your unit must be avoided, as it costs your company money and customer loyalty. For this reason, we place the utmost importance on the smooth supply of important spare parts.

Our central warehouses in the Czech Republic, Switzerland, the United States and China guarantee fast delivery times and short distances for the supply of a wide range of spare parts. The service teams at these locations can be reached via the hotline and always provide top-level support.

As our customer, you get access to our online service database, in which your PVD unit is already entered. Here, in addition to your technical advisor, you will also find detailed information on spare parts for your coating unit, exploded drawings as well as the service history and condition of your machine in order to facilitate targeted problem solving.

Support solutions for rapid assistance with problems

Our mission is to support you in everything that concerns your PLATIT PVD coating unit. From the first questions asked shortly after installation to advice years later.

Training programs will help you and your staff take full advantage of the capabilities of your new PVD unit right from the start.

Our online service database is available 24/7 to provide quick and practical answers to frequently asked questions. In this way, many minor everyday hurdles can be quickly eliminated.

SERVICE HOTLINE

Through our hotline, our service technicians provide full support for more complex issues or difficult problems related to your unit. This extends to remote diagnostics, where our experts go through the process with you step by step to identify the source of the fault.

Of course, we will regularly be at your facility for maintenance if you engage us. At this time, many questions can be clarified, and processes improved if necessary.

Don't forget to ask about our service packages! These packages offer numerous advantages and ensure that your unit always receives the attention it needs.

The Premium Plus package

One example is our Premium Plus package, which aims to increase OEE (Overall Equipment Efficiency). Over the term of the contract, the package includes:

- 24 months warranty
- 4 service technician visits incl. spare parts: 6, 12, 18 und 24 months after commissioning
- Complete support via hotline and internet
- All working hours and travel expenses of the service technicians.

For the first two years, the Premium Plus package guarantees maximum uptime for your coating system, maximum planning reliability, cost transparency, reduced maintenance costs, and improved performance with consistent coating quality.

Upgrades and Retrofits for a long life of your unit

Like any high-tech unit, PLATIT's PVD units are continuously evolving and improving with each generation. With our upgrade programs, you can add new performance dimensions to existing coating units or bring the productivity of your system up to the latest state-of-the-art.

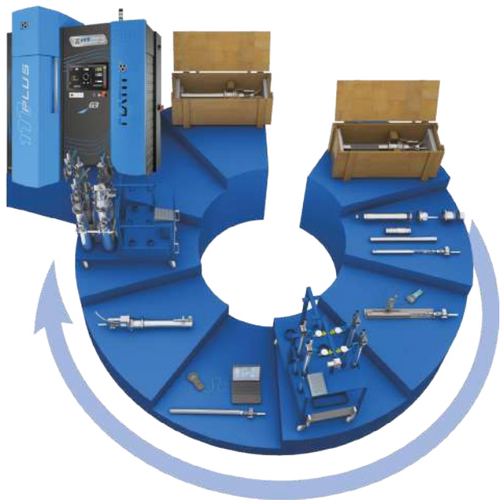
Retrofit measures allow you to technically rejuvenate unit components in a targeted manner and thus significantly extend the overall service life of the unit. Replacing components such as drives, pumps, sensors or controls can boost efficiency, making your PVD unit even more economical to run.

Cathode exchange – uncomplicated and fast

For our customers we have organized the cathode exchange very conveniently. To avoid storage costs, we take care of the transport of new cathodes and the environmentally friendly recycling of your used targets.

We guarantee the first-class workmanship of the targets and their material quality. Our specialists will be happy to explain to you how the cathodes can be replaced quickly and safely.

By the way: All rotating cathodes in PLATIT's Pi coating units have a lifetime warranty if the cathodes are changed regularly at one of PLATIT's cathode exchange centers.



1 REPORTING

You notify us that a cathode needs to be replaced.

2 NEW CATHODE

PLATIT will send you the new cathode within 24 hours.

3 RETURN

After you receive the new cathode, return the old one to us.

4 RECEIPT

Your old, used cathode is received by PLATIT.

5 DISASSEMBLY

The used cathode is disassembled, and the target is recycled.

6 REPLACEMENT

All wear parts are replaced to bring the cathode up to date.

7 INSTALLATION

We check the mechanical functions and adjust the magnetic field to install the new target.

8 TEST

After a long-term vacuum test, the cathode is tested under industrial production conditions.

Cathode exchange centers – close to you

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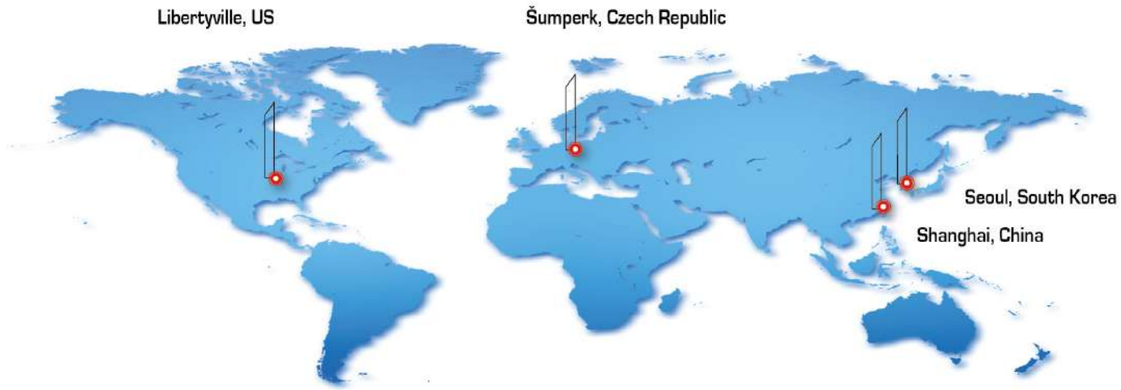

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